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THE PSYCHOLOGY OF THE PRESCHOOL CHILD

THE PSYCHOLOGY OF THE PRESCHOOL CHILD

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D. APPLETON AND COMPANY
NEW YORK LONDON
1924

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PRINTED IN THE UNITED STATES OF AMERICA

B 193p

PREFACE

This book aims to give to psychologists, physicians, welfare-workers, teachers, and parents an insight into the physical, mental, and social growth of a group of normal and superior children between the ages of two and six years. Consecutive daily studies, made in the Preschool Laboratories of the Iowa Child Welfare Research Station over a period of from one to three years for each child, include scientific measurements, experiments, and observations by the writers and their graduate-student assistants, with the purpose of discovering basic laws of development and some fundamental character and personality traits of young children.

The book furnishes tentative standards for the measurement of physical and mental development in preschool children, a field in which little scientific information has been published. For those who are in any way responsible for the education of a little child, the writers offer the results of their experience. If, at the present time, any one conclusion stands out more clearly than the rest, it is that the policy of letting the child "just grow" to the conventional age of school entrance must give way to a definite program of awakening in the child before school age wholesome interests and attitudes, insuring normal growth, and measuring progress from time to time by some such scientific educational means as are described in this book.

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CONTENTS

PAGE

Preface v

CHAPTER

I. Interest in the Preschool Child 1

II. Physical Growth 26

III. Mental Development: Experiments in General Intelligence and Learning 50

IV. Mental Development: Experiments in Motor Control and Coördination 74

V. Mental Development: Experiments in Perception, Association, and Language 106

VI. Mental Development: Experiments in Æsthetics: Rhythm, Design, and Proportion 141

VII. Mental Development: Experiments in Concepts of Weight, Number, and Time 152

VIII. Mental Development: The Relation of Practice, Sex, and Some Physical Traits to Mental Traits 170

IX. Daily Program and Laboratory Equipment . . . 180

X. Educational Activities 201

XI. Social Development 235

XII. Conclusion 255

References 267

APPENDICES

I. Children's Stories and Books 277

II. Children's Songs 280

III. Phonograph Records 283

IV. References on Physical Education 288

V. References on Occupational Activities 289

VI. Supply Houses for Materials and Apparatus . . 290

VII. Guide for Obtaining Home Information 293

Index 297

THE PSYCHOLOGY OF THE PRESCHOOL CHILD

CHAPTER I

INTEREST IN THE PRESCHOOL CHILD

The present widespread interest in the preschool child is reflected in many provisions for the physical care, the educational treatment, and the mental hygiene of young children. The establishment of clinics, playground centers, and welfare stations everywhere reflects the new social attitude toward infancy and childhood and provides for increase and diffusion of knowledge concerning the health and development of children. This modern interest in the conservation of the child is shown by the increasing number of child-protective laws. Among such national measures in the United States may be mentioned the law establishing the Federal Children's Bureau, 1912, "to investigate and report upon all matters pertaining to the welfare of children and child life," with particular reference to the preschool ages, and the Sheppard-Towner Act granting federal aid for health education clinics for mothers and young children. A summary of some phases of the preschool movement from the standpoint of public hygiene will be found in Gesell.[51] *

The new spirit is also manifest in the growing recognition of the fact that physical care alone is not sufficient for normal development. The extensive playground movement

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* Superior figures indicate references at the end of the book.

has already taken cognizance of the importance of play to supply the needs of the active mind of the small child. Modern public libraries, too, are extending their work in the form of play corners, story hours, and simple dramatizations to reach very young children. Educational institutions also have felt the influence of the shift of interest toward the younger ages, and kindergartens are now admitting children at an earlier age, and parents making efforts to secure to their preschool children the benefits of coöperative activity in educative play groups.

Almost all these medical and educational provisions for childhood have been based on "common-sense methods," however, methods founded more upon the unsystematized observations of physicians, nurses, teachers, and parents than upon scientific information acquired through systematic research into the physical and mental development of the child.

The beginning of such research is assured by the fact that psychology has really rediscovered the preschool child. Although interest in the descriptive aspects of child psychology started in the seventeenth century, the development of experimental psychology was not begun until 1878, by Wundt; it was part of the physiological movement; it progressed through the study of the sense organs and reaction-time phenomena, with adults as laboratory subjects. Consequently the study of the adult mind was being carried on by precise scientific methods while the study of the child mind was still limited to diaries and the filling out of questionnaires for psychologists.

The subsequent triumph of the experimental method in animal and comparative psychology, in educational psychology, in the mental test movement, and in behaviorism, has given us the basis of an experimental psychology of infants and young children. The newer point of view in abnormal psychology, resulting from an appreciation of the instinctive and emotional bases of mental adjustments, has thrown further light on the earlier ages in mental development. The new experimental psychology of the preschool child will greatly modify and enrich our conception of the developmental process during the first years of childhood.

The Aim and Scope of This Book

This text aims to present the results so far obtained from a series of three years' observations and experiments on normal and superior children from two to six years of age in the Preschool Laboratories of the Iowa Child Welfare Research Station of the State University, Iowa City, Iowa. In order to give a background for the experiments, the literature on the psychology of the young child has been reviewed briefly. An attempt has been made to keep in mind constantly the needs of psychologists, physicians, teachers, playground instructors, social workers, and parents who are daily called upon to make practical provision for the needs of child development. It is expected that those who are associated with young children will be better able to do their work if they have a fuller understanding of the contributions that science has so far made to the psychology of the preschool child. The book has a direct bearing on the psychology of the older child of school age, since a conscious effort has been made to trace the early development of normal and defective physical and mental traits with a view to training the former and preventing the latter, as far as possible, in subsequent stages of development.

The later chapters of the book describe in detail the preschool laboratories in which our studies are being made and the methods used in the last three years with the 105 normal and superior children from two to six years of age who have been our subjects during this period. Certain technical sections of the book will be of more interest to psychologists; other material will be more useful to teachers or parents of young children. An attempt has been made to meet this situation by printing the more detailed and technical sections in the discussion of each subject in finer type. For the convenience of those interested in educational activities with the preschool child the appendix gives lists of books, songs, and phonograph records, references on physical education and occupational activities, and names of supply houses for material and apparatus.

The results of the psychological study are in the form of tentative norms of development and analyses of various phases of mental and motor growth. Special experiments have been undertaken on the formation of associations and motor habits; on the building up of the basic concepts of number, quality, quantity, time, weight, and other relationships; on the rise of artistic appreciation for color, rhythm, and form; on the growth of vocabulary and correct speech; and on the beginning of such social attitudes as coöperation, responsibility, and status in relation to others of a group.

The educational program has been systematically carried out by trained teachers accustomed to dealing with young children, but without any special effort to prove or disprove a particular theory of education. The results are an accumulation of materials, projects, and individual and group activities of preschool children from day to day. The same is true of the social organizations of the laboratory group, since these are the outgrowth of the children's reactions to each other and to the teacher and assistants.

Historical Background of Experimental Studies

In order to see the relation of this experimental approach to previous work in child study, it is of value to follow briefly the history of work on the psychology and training of the young child.

General Treatises on the Preschool Child

In modern times interest in the theory of the education of the young child began with Comenius[20] whose *School of Infancy*, written in Czech, 1628 to 1630, was published in German in 1633. As part of his ladder system of education Comenius included the school of the mother's lap, where the child from infancy up to the age of six was to obtain the rudiments of all knowledge. His rather formidable list of subjects to be taught merely meant that the child should be given some training in language expression and good habits, and some understanding of the common world about it. His emphasis on physical education and on activity foreshadowed the best thought of almost three centuries later. His understanding of the necessity of concreteness in elementary education was reflected in the illustrations in his *Orbis Pictus*, 1658, which, though designed for the Latin instruction of older children, is the predecessor of a long line of picture books.

The theory of education was carried on by Locke's[82] *Thoughts on Education*, 1693, which emphasized the importance of natural methods of education as opposed to the harsh disciplinary methods of the time. Locke recognized the existence of "native propensities" and "natural inclinations" in the child's mind, and pointed out the responsibility of the tutor in developing in the child the proper ideas and habits. His discussion foreshadowed the later psychological and biological points of view characteristic of educational theory in the nineteenth century.

Locke's influence in England was followed by Rousseau's,[117] whose *Émile* appeared in 1762 as the reflection of the political and social ideas of his time, which looked upon man as the originator of law and social regulations and conceived of human duty as the following of nature. In describing the training of Émile from infancy, Rousseau elaborated the now time-worn doctrine of education according to nature with its emphasis on individual freedom as opposed to the restraint resulting from life in social units, its insistence on spontaneous activity rather than habit, and its glorification of the trial and error method of learning. *Émile,* which stands out as the first book that stressed the study of the child itself, was followed by a long line of treatises on the development of the child, all based more or less upon observation.

Rousseau's doctrines spread to Germany where they greatly influenced Basedow,[11] who embodied his ideas in a *Methodenbuch für Väter und Mütter der Familien und Völker,* 1770, and attempted to apply these ideas to the education of his infant daughter Emilie. Basedow understood in a measure the instincts and interests of children and permitted them free development in his school. The influence of his "Philanthropinum" extended to much later work with younger children.

Rousseau's naturalism was continued in the methods of developing sense perception through observation, as advocated by Pestalozzi in Germany and Switzerland. Rousseau's emphasis on motor development was reflected in the provision for industrial training made by Pestalozzi,[105] whose belief that education should aid the natural growth of the child's powers was the result of actual study of the child and of the concrete objects in which it is interested. His observations on the development of his three-and-a-half-year-old son from January 27 to February 19, 1774, are probably the first actual records of the development of a young child. Although they were not published until much later, they mark the beginning of the parents' diary movement. All of Pestalozzi's writings reveal his understanding of the fact that a child needs not verbal instruction, but concrete material for learning and concrete situations for moral development.

In Germany, Herbart's [59] writings, from 1800 to 1831, while primarily on methods of instructing school children, added to Pestalozzi's principle of observation the doctrines of apperception and interest as contributions to the psychologizing of education.

The first attempt to outline a complete system of education for the preschool child was Froebel's [47] *Education of Man*, 1826, which continued the naturalism of Rousseau and amplified some of the ideas of Comenius. In 1837, Froebel established at Keilhau, Germány, a school for children between the ages of three and seven years, very felicitously named *Kindergarten*. He emphasized motor activity as a means of learning, but insisted on the social aspects of education instead of on individual expression alone. He believed that through coöperative activities in play, the moral qualities of justice, moderation, self-control, thoughtfulness, loyalty, brotherly love, and strict impartiality are cultivated. Here we have the doctrine of socialization, which is one of the chief arguments in favor of early participation in group activities. Froebel's philosophical system with its artificial symbolisms has become conventionalized by injudicious followers, but his practical contributions in the form of playthings, games, and songs, and his principles of self-activity and creativeness have had a lasting influence on preschool education. The Pestalozzi-Froebel house at Berlin has carried further the ideas of both of these pioneers in preschool educational methods.

Although the kindergarten, which was a democratic movement, never gained much footing in Germany because of governmental suspicion of its political influence, the idea spread in Austria, Italy, France, and England, and came to full development in America, where its spirit has worked upward through the grades and downward into institutions for the care of younger children.

After Froebel, treatises on the development of the child became more frequent. In 1828, Necker de Saussure [93] published in France the first volume of her work on Christian education in which, notwithstanding the fact that her chief concern was moral development, she made some very trenchant observations on mental development during the first four years. Löbisch's [81] work of 1851 had considerable influence even outside of Germany. In 1893, there appeared in French the first edition of Compayré's [21] treatise on the intellectual and moral development of the child. A similar treatise by Oppenheim [100] appeared in America in 1898. Sully's [131] collection of English studies, 1896, was only one of the contributions of this writer on the psychology of early childhood. In America, J. Mark Baldwin's [6] *Mental Development in the Child and the Race,* 1903, contains the germs of much of the later experimental work on the preschool ages, and the early *Notes on Child Study* of Thorndike,[137] 1903, are exceedingly fertile in suggestions for further study of the mental development of the young child. To this same period belong the works of King,[74] 1903, Tanner,[134] 1904, and Ament [1] (several editions), which are mainly compilations and discussions of material from other investigators. Barnes' [9] collections of studies, 1896 to 1902, and Gruenberg's [56] *Outlines of Child Study,* 1922, belong in the same class. Major's [86] *First Steps in Mental Growth,* 1906, is based more upon first hand material. Gaupp's [49] *Psychologie des Kindes,* 1908, contains a good summary of the facts known in regard to the development of the little child, with references to the literature.

The last two decades have seen the publication of numerous general treatises, among which may be mentioned those of Sikorsky,[126] 1902, W. B. Drummond,[40] 1907, Groos,[55] 1904, Tracy,[142] 1910, Claparède,[19] 1911, Kirkpatrick,[76, 77] 1911 and 1917, Waddle,[143] 1918, M. Drummond,[38, 39] 1918 and 1920, Norsworthy and Whitley,[97] 1918, Bühler,[18] 1918, and Rasmussen,[113, 114] 1918 and 1921.

Biographies of Babies

Pestalozzi's journal,[105] as already mentioned, was the first of the studies of individual children that later became almost synonymous with "child study." Other diary material, which had little influence, however, until translated from the German into French years later, was contained in Tiedemann's [139, 140] observations on the early years of his children, first published about 1787. Tiedemann may be considered the first conscious student of the preschool child, since he realized the importance of studies on the early manifestations of developing mental abilities and regretted the paucity of such observations. In *Kind und Welt,* 1856, Sigismund [125] made a comparative study of the phenomena of the early years in his own child and in several other children. Of importance not only as a diary, but also as a systematic treatise, was the book of Perez,[103] 1878, in which he traced, during the first three years, the development of the sentiments, reasoning, and judgment, with anecdotal illustrations. Perez,[104] in his study of 1886, covered the remainder of the preschool period. The classical work on the subject of the development of the young child was for many years Preyer's [111] *Seele des Kindes,* 1882, in which, besides systematic observations on the development of the senses, the will, and the intellect, are reported the earliest experiments on preschool children. The translations of Perez' and Preyer's works led in America to a long line of "baby books," in which ambitious parents recorded such observations as they were able to make. This movement was really stimulated in America by G. Stanley Hall, who induced thousands of parents and teachers to fill out questionnaires in regard to the mental development of children from actual observation or from reminiscence of their own childhood interests. Among the more important baby biographies that resulted were Shinn's [122, 123, 124] *Notes,* published between 1893 and 1907, and the baby records of Moore,[91] 1896, Mrs. W. S. Hall, [58] 1896, Hogan,[61] 1898, and G. Van N. Dearborn,[25] 1910. In recent years there has been a revival of interest in the subject, with the publication of diaries by the Scupins,[121] 1907, Dix,[36] 1911 to 1914, and the Sterns,[130] 1914. Simon's [127] questionnaire to be used as a guide in the observation of a young child is the beginning of an attempt to make parents' notes scientific. A more recent outline of this sort is by B. T. Baldwin,[5] 1922.

Experimental Studies on Special Phases of Child Development

The first avowedly experimental study of the mental life of the child was made by Bartholomai and Schwabe,[10] 1870. Their investigation of the contents of children's minds on entering school stimulated similar studies, by Lange,[79] 1879, G. Stanley Hall,[57] 1883 and 1891, and Netschajeff,[94] 1910. Studies of perceptual processes were begun early by Preyer,[112] 1897, and summarized by Schmidt,[120] in 1910. Work on the origin of the notion of color was reported by Decroly and Degand,[27] 1911.

Number Concept.—Since Binet's [14] early studies, 1890, there has been considerable work on the development of the number concept, but usually it has been done by parents without good control of the conditions. Short articles have been published by Webber,[147] 1914, Lucas,[83] 1914 and 1915, Noon,[96] 1919, Court,[22, 23] 1920 and 1923, and Filbig,[43] 1923. A scientific study was made by Decroly and Degand,[28] 1912, and by Beckmann,[13] 1923.

Performance.—Studies of the ability of children with special types of motor tests have been issued by Goddard,[52] 1915, and Porteus,[109] 1915. Pintner and Anderson,[106] 1917, Pintner and Paterson,[108] 1917, Wallin,[144] 1918, and Ide,[68] 1918, have published work on performance tests with young children. Recently Johnson,[66] 1921, Johnson and

Schriefer,[70] 1922, and Woolley and Cleveland,[153] 1923, have computed norms for the so-called "performance tests."

Language.—Work on the development of speech and vocabulary has been so voluminous that it would be impossible to give all the studies in this summary. One of the earliest accounts of the development of speech was given in Heyfelder's work of 1857 to 1858. Taine's[133] note in French on the acquisition of language in an infant, 1876, inspired the publication of Darwin's[24] *Biographical Sketch,* 1877, which had been written thirty-seven years before. This article, which also contained observations on reflexes and instincts, started the child study movement in England. An early American account of the vocabularies of children under two years was published by Holden,[62] 1877. Systematic accounts of the psychology of language development have been published by Oltuszewski,[99] 1897, Ament,[2] 1899, Meumann,[89] 1903, the Sterns,[130] 1907, Schäfer,[119] 1921, and Jespersen,[69] 1922. A summary of special studies, usually on the vocabulary of only one child, is included in the work of Tracy,[142] 1910, Gerlach,[50] 1917, Bateman,[12] 1917, Magni,[85] 1919, Nice,[95] 1920, and Esper,[42] 1921. A study of the vocabulary of a number of kindergarten children was made by Drever,[37] 1919.

Drawing.—A considerable literature has accumulated on the subject of children's drawing. Since the early discussions by Barnes,[8] 1893, and Brown,[17] 1897, there have been many collections and interpretations of children's attempts at drawing. Thorndike,[138] 1913, has developed a scale for measuring the merit of drawings. Discussions of the psychology and pedagogy of drawing will be found, with some bibliographical material, in the texts of Freeman,[46] 1916, Gordon,[53] 1917, Waddle,[143] 1918, and Hollingworth,[64] 1923.

Miscellaneous.—Decroly and Degand,[29] 1913, have written about the development of the notion of time, as have also Oakden and Sturt,[98] 1922. A beginning of the study of the growth of "social perception" has been made by G. S. Gates,[48] 1923, and an inventory of habits in two-year-old children has been made by a group at Columbia University,[31] 1923. The subject of play in man was treated by Groos,[54] 1901. Memory was studied by the Sterns,[129] 1909, Ballard,[7] 1913, and Reymert,[115] 1923. A detailed analytic study of five- and six-year-old children just entering school was made by Town,[141] 1921, by means of a large group of tests. An analysis of the development of children from two to seven years, made by Descoeudres,[32] 1921, includes studies of language, observation, number concept, manual aptitude, and judgment.

Modern Tendencies

A survey of the interest in the preschool age would not be complete without taking into account the effect of certain modern movements.

Mental Measurement

The whole movement for the mental measurement of young children, begun by Binet and Simon,[15] 1905, has resulted in pushing the field of psychological investigation farther and farther down the scale of ages, and has stimulated much work on tests for young children. Among the writers who have devised complete scales may be mentioned Terman,[135] 1916, Herring,[60] 1922, and Kuhlmann,[78] 1922. Single tests for young children have been developed by Baker and Kaufmann,[3] Pintner and Cunningham,[107] Bird,[16] Engel,[41] Holley,[63] Kingsbury,[75] Otis,[101] Pressey,[110] Myers,[92] and W. F. Dearborn.[26]

Psychanalysis

The contribution of the psychanalytic movement to our understanding of the importance of the early years is exemplified in the books of Hug-Hellmuth,[65] 1913, Lay,[80] 1919, and White,[149] 1919. Woolley,[151] 1923, has reported case studies of two young children with sex complexes that greatly hindered normal mental adjustments. Thom,[136] 1922, has worked with young children in habit clinics designed to prevent and overcome such maladjustments.

Behaviorism

The behaviorists have contributed a technic that is very useful in the study of young children. This school stresses the study of objective movement rather than the analysis of the data of consciousness. Since the young child is handicapped by language difficulties and has little skill in introspection, this method is particularly applicable to the study of the preschool child. Work done by this method on the establishment of conditioned reflexes has added much to our knowledge of habit formation. In this sort of experiment the experimenter so arranges the situation, together with rewards and punishments, that the subject responds to any desired stimulus in a way in which the subject would naturally respond reflexly only to certain specific stimuli. For example, experiments were made in Russia by Pavlov, in which a dog was shown food while a bell was rung. Thereafter the mere ringing of the bell stimulated the flow of saliva in the dog's mouth, a reflex that normally occurs only when food is shown. The behavioristic standpoint is explained by Watson,[145] 1921, who also has made experimental studies on infants by this method,[146] 1921. Similar experiments have been reported by Katz and Révész,[73] 1909, Katz,[72] 1913, and Hunter,[67] 1913. Mateer's [88] book, 1918, contains a series of experiments by this method.

Socialized Education

The pragmatic educational philosophy of Dewey, developed from 1899 to 1913, has probably had as much influence on preschool education as had that of Froebel. There are indeed many points of resemblance between them. Froebel's emphasis on motor activity, on learning by doing, has been revived by Dewey, together with his insistence on the social aspects of education. In a series of publications Dewey,[33, 34, 35] 1899, 1902, and 1913, has elucidated the doctrine that education is not merely a preparation for life, but life itself; that the school should provide, through coöperative activities and mutually helpful living, a reproduction on the child's plane of the activities of adult society; that interest and instinctive attitudes are the indispensable basis of learning; that the curriculum should provide practical scientific and industrial projects and encourage production and creative activities in order that knowledge may be firmly established. Dewey's pedagogical reforms in the school for children from four to thirteen years, which he directed at Chicago, were based on the idea of awakening in children energy, originality, and initiative. He revolutionized the formal work of the kindergarten, substituting the natural activities of the household and garden for the conventional occupations, and effecting a reinterpretation of the play of young children.

Montessori Movement

Other important educational adjustments resulted from the work of Montessori,[90] who started work with young children in 1907 in Italy. Beginning with the education of the mentally defective, she found that many of the methods of sense training could be adopted in the education of normal children in the earliest years. This has occurred several times in the history of education. Seguin's devices for teaching form are in common use, not only as tests, but also as training material. Montessori owes much to his work. So, too, Decroly and Monchamp's [30] educative plays, 1922, are equally useful in the training of defectives and of young children. The Montessori methods which were used in so many schools in America have been convincingly set forth by Fisher,[44] in America. The material is largely self-administrative, thus encouraging initiative and furnishing a real motive for learning. It is possible that Montessori used apparatus for sense training under the mistaken notion that some general powers of the mind are trained thereby. Nevertheless, the real appeal which the material makes to the manipulative and constructive impulses of children and the spirit of mutual helpfulness and understanding that prevails in her "houses of childhood" mark the Montessori movement as a forward step in the history of preschool education.

Nursery School Movement

Perhaps the most significant advance in preschool education in recent years is the nursery school movement. The early development of training centers for young children is bound up with the history of the infant schools. The first of these was established by Oberlin at Walbach, France, 1774. In England the movement owed its inspiration to Robert Owen, whose famous school, begun at New Lanark, 1816, did a great deal for the physical and mental improvement of the children of factory laborers. These infant schools degenerated, however, into mere places of formal instruction, and the spirit of progress was better expressed in the free kindergartens established in the slums of large cities. In 1908, the British Board of Education recommended the establishment of nursery schools, and in 1918 the Education Act made possible the establishment of such schools throughout the country for children from two to five years. The type of work done in such schools is described in the books by McMillan,[84] 1919, and Owen,[102] 1920. Provision for cleanliness and physical care, attention to remediable defects, proper nutrition, emphasis on habit formation, and an atmosphere of wholesome freedom and affection are the special merits of the nursery schools. Their pedagogical principles are in line with the naturalistic doctrines previously discussed, and their equipment frequently includes kindergarten and Montessori material. The function of these schools in England is philanthropic and educational, rather than experimental.

In the German schools, as exemplified in Prussia, children were taken into infant schools at two years, but no special provision was made for modern educational care. In the French schools, as exemplified in Paris, children were admitted to the *école maternelle* at three years. In both countries a system of day nurseries, or *crèches,* cared for younger children during the day. In America the development resulting from the establishment of the Sunday schools and nurseries, infant schools, day nurseries, and kindergartens has fused with the nursery school movement, so that we are beginning to see the growth of numerous nursery schools, a few of which provide for experimental work.

An account of a nursery school experiment in New York by the Bureau of Educational Experiments has been published by Johnson and Reuben,[71] 1922. The nursery school at the Merrill Palmer School in Detroit, which is described by Woolley,[152] 1922, is furnishing data for scientific publications and articles on young children.

The Iowa Preschool Psychological Laboratories

There are, of course, many obstacles in the way of the psychologist who wishes to study young children, and some of these have operated to limit the number of studies made in the past. In the first place, children of this age are difficult to secure as subjects, unless the experimenter happens to have some in the family. It is possible for an enterprising experimenter to make appointments with parents to have children brought to a laboratory or to allow them to be tested in the home, but the energy and time consumed in examining a few children in this way are altogether out of proportion to the results. The home environment, moreover, does not usually permit of controlled experimental conditions.

Groups for Psychological Observation

In September, 1921, the Iowa Child Welfare Research Station opened a preschool laboratory for experimental work with two groups of children, one of children from two to three years of age and one of children from three to four. In September, 1922, the Station organized, in coöperation with the College of Education, an additional junior primary group of children from five to six years. One hundred and five children have been in attendance for from one to three years in the three groups. The children from four to five years are distributed between the two older groups, according to their maturity. Children are admitted only after a short preliminary examination to determine that they are of normal intelligence and to decide on the basis of their general development in which group they shall be classified. A number of the children are from the homes of university professors or graduate students, some from those of the business men of the town, and a few from good working class homes.

The nominal tuition fee of $11.00 a year, charged in each of the three groups, makes possible the attendance of children from moderately well-to-do families.

The children come to the laboratories in a variety of ways. The youngest come with a parent or an older brother or sister; some are carried, some wheeled in go-carts; some walk and some ride tricycles or "kiddie kars." One or two walk alone from their homes on near-by streets. A number of the children are conveyed by a taxicab company which makes a special rate for the school.

It will be of interest, not only to psychologists who wish to know the conditions under which the experiments are performed or who contemplate establishing similar experimental groups, but also to parents and educators who are concerned with the practical aspects of child training, to have a brief description of the physical equipment of the laboratories, of the program of activities, and of the arrangements whereby it has been possible to collect the data presented in this book.

The Laboratory for Younger Children

The preschool laboratory building (Fig. 1) was especially designed and furnished for this work with little children. It consists of an entrance hall, a large group room, three experimental rooms, a pantry, and a lavatory. As may be seen from the floor plan (Fig. 2), the main group room is at the front of the building, with twelve large windows admitting light from three sides. Hinged

FIG. 1. THE WAY TO MAKE FLOWERS AND CHILDREN GROW.

to the wainscoting at three sides of the room are a dozen little lattice gates, which may be swung into the room to form partial enclosures in which the children play individual games and lie during the midmorning rest period (Fig. 3). In addition to the radiators set high above the reach of the children, steam pipes run under the floor, so that the children can play on the floor even during the coldest weather. Opening from the group room are a lavatory and a small pantry with a sink and a gas stove. The plumbing fixtures are small and set low for the use of little children. A large cupboard and the entrance hall, which also serves as a cloakroom, isolate the three experimental rooms from the group rooms.

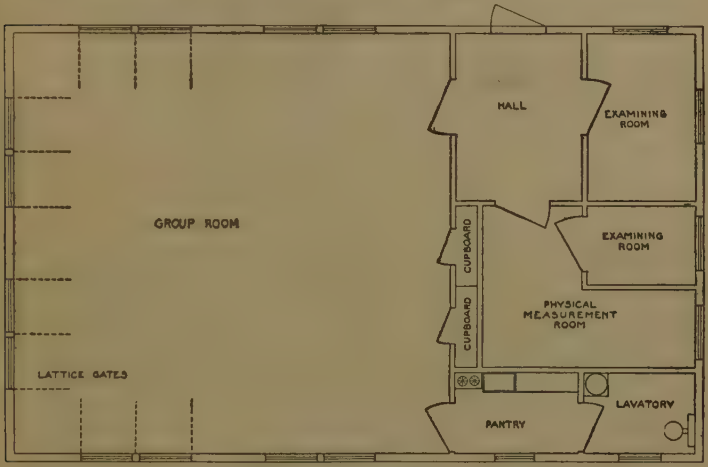

FIG. 2. PLAN OF PRESCHOOL PSYCHOLOGICAL LABORATORY BUILDING.

Throughout the building the woodwork and furniture are stained moss green, and the walls of cream beaver-board are paneled with green wood strips. Chintz curtains in nursery-rime pattern hang at the sides of the windows, whose broad sills are covered with potted plants. There

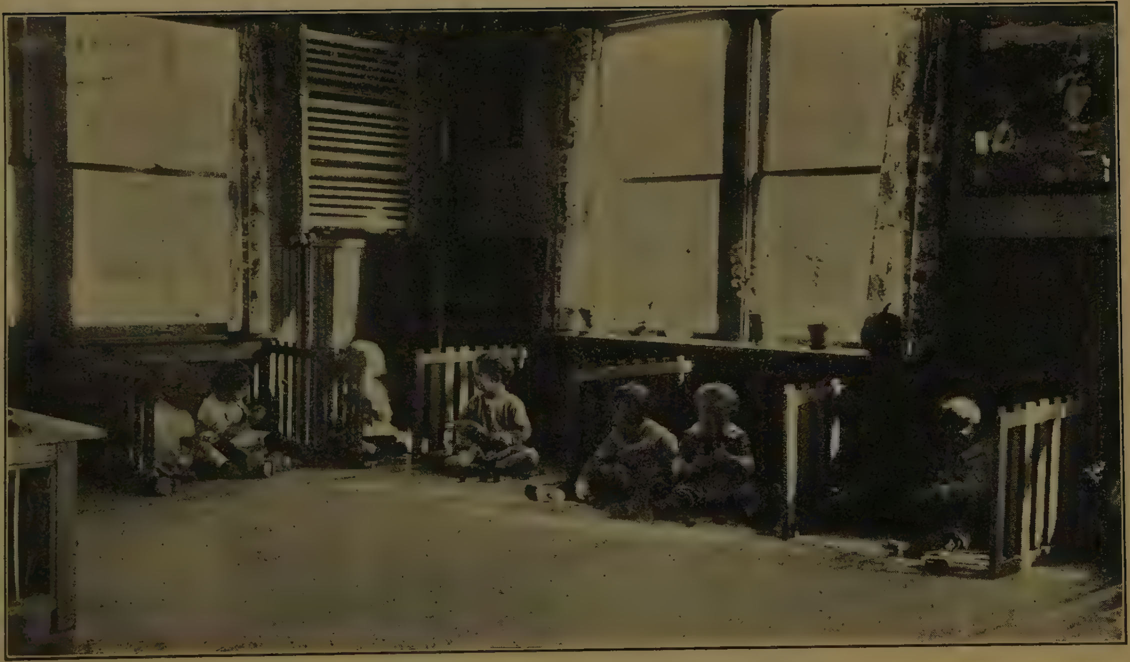

FIG. 3. THE GROUP ROOM IN THE PRESCHOOL BUILDING.

are small low tables and chairs of attractive design. Large hand-colored illustrations of fairy tales add to the charm of this very homelike room.

There are a sand table, a slide, a set of large building blocks for making real houses, a doll house, a phonograph with special records for young children, and a great variety of material for occupational projects. The materials for hand work, the books, and the blocks are within easy reach on low shelves.

A large yard furnished with swings and a teeter-board provides ample room and protection for outdoor play periods.

The Laboratory for Older Children

The junior primary room is in the University Observational School, which includes a complete school system through high school, conducted by the College of Education. The room has been made very attractive with pictures, plants, an aquarium, and low shelves for books and work materials. Further decorations are planned and executed by the children, who often bring playthings, books, and beautiful objects from home for the others to enjoy.

The junior primary children make use of the play facilities of the special preschool building and yard and often exchange visits with the younger children in the execution of group projects and in preparation for parties.

Occupations and Research Activities

The two groups of younger children spend one and one-half hours five days a week in the preschool laboratory building; the younger children come at nine o'clock and remain until ten-thirty, when the older group arrives. The junior primary children spend three hours each day in their group room in the University Observational

School. They are examined in the experimental rooms of the Observational School.

The children of all three groups are occupied during the morning with a very simple and flexible schedule of free play, singing games, stories, rhythmic exercises, and simple occupational projects. Every effort is made to have the atmosphere natural and free from unwholesome stimulation. The educational work, which is not patterned on any theory or kindergarten practice, has demonstrated the possibility of coöperative enterprise among children of an age that is usually considered purely individualistic, and, as may be seen from Chapter X, has furnished a great deal of data on the types of activities suitable for children of this age.

A graduate assistant keeps a detailed log book of daily observations made on the children and notes interesting reactions and the conditions under which new abilities develop. These data are being used for a study of the social attitudes and behavior of little children who are becoming adjusted to a normal group environment while still enjoying the characteristic individual activities of early childhood. Investigations are also made into the heredity, home conditions, and special characteristics of the families of the children. Some of the results of these social studies are given in Chapter XI.

The children are taken from the group activities at any time and enjoy the individual mental and physical measurements in the examining rooms. Each child is measured in a series of physical traits once a month on the date of its birth. The results, which are the first collection of consecutive measurements on any considerable number of preschool children, are described in Chapter II, together with the results of the medical examinations and roentgenograms (X-ray photographs) of the wrist bones and teeth.

All the children take part in a variety of psychological experiments, the aims of which are to get an insight into the psychological development of children at these early ages, to devise tests for certain abilities in younger children, to establish norms, or standards, of performance by the use of these children and others, and to determine the extent to which laboratory work may be carried on with young children. The psychological work, details of which are given in Chapters III to VIII, shows the feasibility of using young children as observers.

The same experimental program is carried on with all three groups. It is planned to continue these studies with younger children each year, and, when possible, to follow the children through the University elementary and high school in order to get additional consecutive data on mental and physical development.

Advantages for Research

The preschool psychological laboratories of the Iowa Child Welfare Research Station do not constitute a nursery school in the strict sense, but are an experiment station where during a few hours of the day a number of children are under observation and scientific experimentation.* At the time the laboratories were organized this arrangement seemed more feasible than an all-day nursery program in which much time must be given to the physical care of the children, dressing and undressing them, putting them to bed, giving them their meals, and looking after their health habits. The children spend in the preschool laboratories what is probably their optimum period for work and play, and consequently are always accessible for psychological and educational experiments. It is also possible with limited space to study a great many children, since each child in the two younger groups spends only a relatively short period in the laboratory. Systematic research with such groups of young children will soon result in a substantial increase in our knowledge of the psychology of the preschool child.

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* In conducting the work and experiments described in the book the writers have had from time to time the help of the following graduate research assistants: Gladys Davis, Eva Fillmore, Harriet Horn, Frances Hungerford, Julia Kirkwood, Helen Moon, Ethel Verry, Ruth Washburn, Helen Watson, Beth Wellman. Medical and dental examinations and roentgenograms were made through the courtesy of the University Colleges of Medicine and Dentistry by Dr. William J. McDonald, Dr. Bundy Allen, Dr. Charles L. Drain, Dr. Ernest A. Rogers, and the University School nurse, Laura Chennell.

Benefits Derived by the Children

The parents of the children are greatly interested in the research findings and avail themselves of the opportunity for advice and consultation with the staff. If justification beyond the value of the research results were needed for the maintenance of these preschool groups, it would lie in the usefulness of these educational demonstrations. The later educational and social treatment of the child rests upon the achievement of these first years in the growth of a sound body, the development of motor control and poise, the building up of perceptions and concepts, the beginning of æsthetic impulses, the promotion of proper habits and character traits, and the early acquisition of a group consciousness. It is obvious to parents and to other observers that the children are often better off in the laboratories than in their homes. The equipment and arrangement are better suited to the use of little children than are the furnishings of the average or even the superior home, where the interests of grown-ups necessarily take precedence. The child has the exclusive attention of trained and experienced adults who will not be irritated by its ceaseless questions and other demands for mental activity that must be satisfied for true mental growth. The presence of a number of children of about the same age gives the child a most valuable social experience. The new experiences, the new objects, the abundance of art, music, and stories, and the educational occupations have a wholesome effect on the mental development of the child, which is reflected in a great increase in vocabulary and fluency of speech. This appearance of new mental life is often so great as to give the impression that the child has increased in intelligence, whereas really the environment has only acted so as to bring out latent powers that might otherwise have lain unawakened until the actual school years, or even longer.

CHAPTER II

PHYSICAL GROWTH

The field of physical measurements is receiving more attention than heretofore because of recent investigations which show that defects of growth may be detected and eliminated. There is also apparently a correspondence between stages of mental growth and stages of physical development. Surprisingly little accurate work has been done on the physical growth of preschool children. Kindergartens, after many years of indifference, are just beginning to introduce physical and mental measurements as an integral part of their programs, and the better kindergarten training schools are also including in their curriculums introductory courses on physical and mental tests. If measurements on kindergarten and preschool children are to be of scientific and educational value, they must be taken consecutively at least semi-annually, by trained observers with standardized technic.

Physical Measurements

The selection of physical traits for anthropometric measurements depends upon the purpose for which the measurements are to be used. For example, physical training teachers desire to know the status of the strength and growth of muscles and they therefore make measurements that include the larger muscles of the arms, legs, and chest. For the investigation of the problem of physical growth, we have selected measurements that include the most significant criteria of physical development: standing height, sitting height, three head measurements, width of shoulders, span of arms, length of upper and lower right and left arms, three chest measurements, width of hips, and weight.

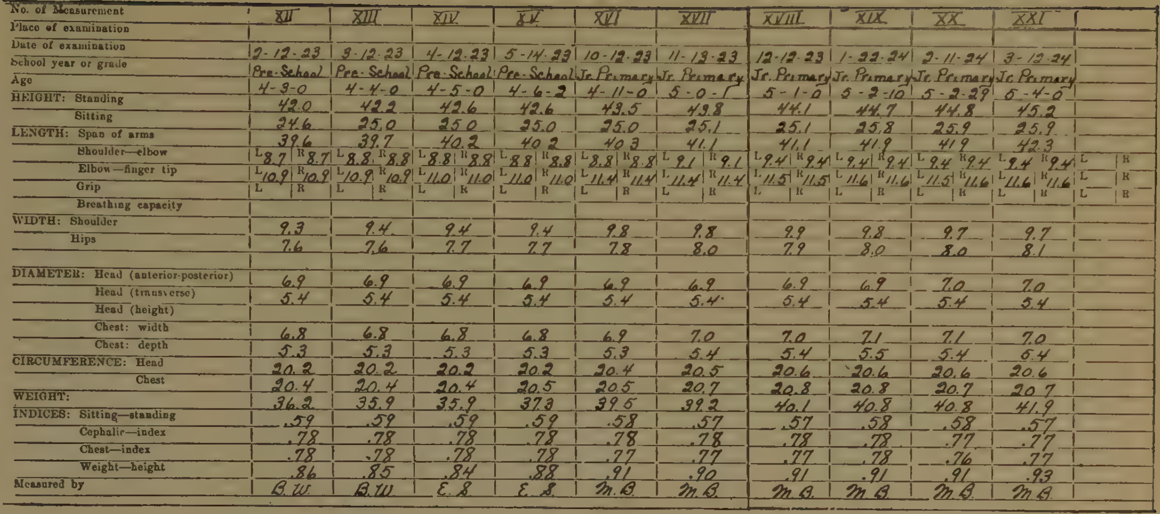
The Routine of Measuring

In the preschool laboratories, sixteen physical measurements are taken each month on or near the child's birthday (Fig. 4). This distribution of the measurements throughout the entire month requires more of the time of the examiner than would be needed if all examinations were made on three or four days, but it makes the measurements comparable. The measurements are taken without clothing, except the slip, as shown in Figures 5, 6, and 7. The room is heated to a temperature of 80 to 85 degrees Fahrenheit. The metallic instruments are carefully warmed to prevent shock to the child and to lessen the chance of deviations in the measurements due to the child's shrinking from contact with cold instruments.

In all of our work we take the age to the nearest month, the nearest half year, or nearest year. For example, a child between one and one half and two and one half years of age is considered two years of age, and between two years and one and one half months and two years, two and one half months is considered two years, two months.

Since the measurements of height and weight are more generally used than the other measurements, and since they furnish the minimum essential for teachers and parents of kindergarten and preschool children, the methods of taking these two measurements are given here in some detail. A full description of the instruments, the technic of taking the measurements and the standards for younger and older children are given in Baldwin's [4] *Physical Growth of Children from Birth to Maturity*, 1921, and a later text, to be published shortly.

No. of Measurement	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
Place of examination	Iowa City										
Date of examination	11-18-21	12-12-21	1-12-22	2-13-22	3-13-22	4-12-22	5-15-22	9-27-22	10-12-22	11-14-22	1-13-23
School year or grade	Pre-School	Pre-School	Pre-School	Pre-School	Pre-School	Pre-School	Pre-School	Pre-School	Pre-School	Pre-School	Pre-School
Age	3-0-6	3-1-0	3-2-0	3-3-1	3-4-1	3-5-0	3-6-3	3-10-15	3-11-0	4-0-2	4-2-1
HEIGHT: Standing	38.0	38.1	38.4	38.5	38.8	39.1	39.3	40.5	40.7	41.0	41.3
Sitting	22.8	22.9	23.0	23.0	23.1	23.5	23.5	23.9	23.7	24.4	24.4
LENGTH: Span of arms											
Shoulder—elbow	L R	L R	L R	L R	L R	L 7.8 R 7.8	L 7.8 R 7.8	L 8.2 R 8.2	L 8.5 R 8.5	L 8.5 R 8.5	L 8.5 R 8.5
Elbow—finger tip	L R	L R	L R	L R	L R	L 10.2 R 10.2	L 10.2 R 10.2	L 10.6 R 10.6	L 10.6 R 10.6	L 10.7 R 10.7	L 10.9 R 10.9
Grip	L R	L R	L R	L R	L R	L R	L R	L R	L R	L R	L R
Breathing capacity											
WIDTH: Shoulder	8.9	8.9	8.9	8.9	9.0	9.1	9.1	9.3	9.2	9.3	9.3
Hips	6.8	6.8	6.8	7.0	7.3	7.3	7.3	7.5	7.6	7.6	7.6
DIAMETER: Head (anterior-posterior)	6.7	6.7	6.7	6.7	6.8	6.8	6.9	6.9	6.9	6.9	6.9
Head (transverse)	5.2	5.2	5.2	5.3	5.3	5.4	5.3	5.3	5.3	5.3	5.4
Head (height)											
Chest: width	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.6	6.7	6.8	6.8
Chest: depth	4.9	5.0	5.0	5.0	5.0	5.0	5.0	5.1	5.1	5.2	5.2
CIRCUMFERENCE: Head	19.8	19.7	19.7	19.8	19.8	20.0	20.0	20.0	20.2	20.2	20.2
Chest	20.0	20.0	20.0	20.0	20.0	20.1	20.1	20.4	20.4	20.4	20.4
WEIGHT:	30.5	31.0	32.3	33.5	33.8	33.0	32.8	34.8	33.3	36.4	35.7
INDICES: Sitting—standing	.60	.60	.60	.60	.60	.60	.60	.59	.58	.60	.59
Cephalic—index	.78	.78	.78	.79	.78	.79	.77	.77	.77	.77	.78
Chest—index	.74	.76	.76	.76	.76	.76	.76	.77	.76	.77	.77
Weight—height	.80	.81	.84	.87	.87	.84	.84	.86	.82	.89	.86
Measured by	B.W.	B.W.	B.W.	B.W.	B.W.	B.W.	B.W.	B.W.	B.W.	B.W.	B.W.



No. of Measurement	XII	XIII	XIV	XV	XVI	XVII	XVIII	XIX	XX	XXI	
Place of examination											
Date of examination	2-12-23	3-12-23	4-12-23	5-14-23	10-12-23	11-13-23	12-12-23	1-22-24	2-11-24	3-12-24	
School year or grade	Pre-School	Pre-School	Pre-School	Pre-School	Jr. Primary	Jr. Primary	Jr. Primary	Jr. Primary	Jr. Primary	Jr. Primary	
Age	4-3-0	4-4-0	4-5-0	4-6-2	4-11-0	5-0-1	5-1-0	5-2-10	5-2-29	5-4-0	
HEIGHT: Standing	42.0	42.2	42.6	42.6	43.5	43.8	44.1	44.7	44.8	45.2	
Sitting	24.6	25.0	25.0	25.0	25.0	25.1	25.1	25.8	25.9	25.9	
LENGTH: Span of arms	39.6	39.7	40.2	40.2	40.3	41.1	41.1	41.9	41.9	42.3	
Shoulder—elbow	L 8.7 R 8.7	L 8.8 R 8.8	L 8.8 R 8.8	L 8.8 R 8.8	L 8.8 R 8.8	L 9.1 R 9.1	L 9.4 R 9.4	L 9.4 R 9.4	L 9.4 R 9.4	L 9.4 R 9.4	L R
Elbow—finger tip	L 10.9 R 10.9	L 10.9 R 10.9	L 11.0 R 11.0	L 11.0 R 11.0	L 11.4 R 11.4	L 11.4 R 11.4	L 11.5 R 11.5	L 11.6 R 11.6	L 11.5 R 11.6	L 11.6 R 11.6	L R
Grip	L R	L R	L R	L R	L R	L R	L R	L R	L R	L R	L R
Breathing capacity											
WIDTH: Shoulder	9.3	9.4	9.4	9.4	9.8	9.8	9.9	9.8	9.7	9.7	
Hips	7.6	7.6	7.7	7.7	7.8	8.0	7.9	8.0	8.0	8.1	
DIAMETER: Head (anterior-posterior)	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	7.0	7.0	
Head (transverse)	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	5.4	
Head (height)											
Chest: width	6.8	6.8	6.8	6.8	6.9	7.0	7.0	7.1	7.1	7.0	
Chest: depth	5.3	5.3	5.3	5.3	5.3	5.4	5.4	5.5	5.4	5.4	
CIRCUMFERENCE: Head	20.2	20.2	20.2	20.2	20.4	20.5	20.6	20.6	20.6	20.6	
Chest	20.4	20.4	20.4	20.5	20.5	20.7	20.8	20.8	20.7	20.7	
WEIGHT:	36.2	35.9	35.9	37.3	39.5	39.2	40.1	40.8	40.8	41.9	
INDICES: Sitting—standing	.59	.59	.59	.59	.58	.57	.57	.58	.58	.57	
Cephalic—index	.78	.78	.78	.78	.78	.78	.78	.78	.77	.77	
Chest—index	.78	.78	.78	.78	.77	.77	.77	.78	.76	.77	
Weight—height	.86	.85	.84	.88	.91	.90	.91	.91	.91	.93	
Measured by	B.W.	B.W.	E.S.	E.S.	M.B.	M.B.	M.B.	M.B.	M.B.	M.B.	

FIG. 4. INDIVIDUAL RECORD CARD FOR REPEATED MEASUREMENTS OF PHYSICAL GROWTH.

The child is taken into the measuring room alone with the examiner, since the presence of other persons in the room during the measuring sometimes proves to be a disturbing factor. The children are accustomed to working with the examiner and soon grow used to the sight of the unfamiliar instruments. A young child is more difficult to measure than a school child, who is better able to remain motionless. In a few cases it is difficult to secure accurate measurements for the first months because the child can not

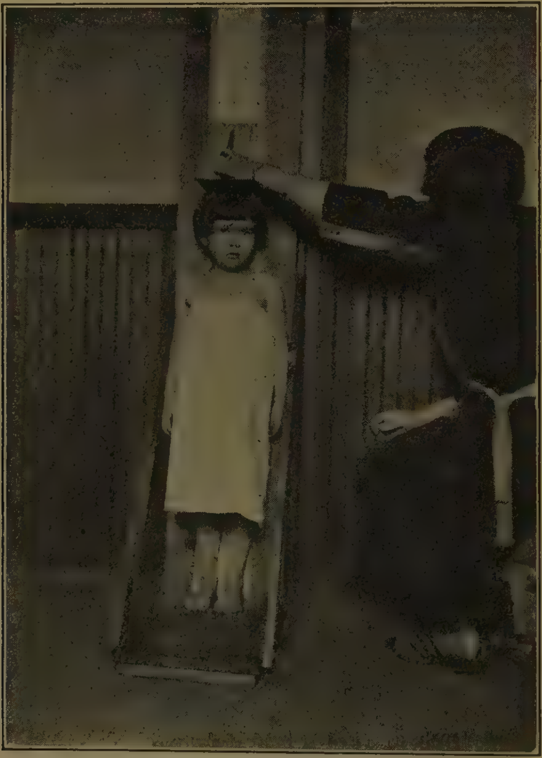


FIG. 5. STANDARD METHOD OF MEASURING HEIGHT.

be induced to stand still, but this attitude is very much improved for subsequent measurements.

While the standing height is being taken, the child stands with heels together, heels, upper part of back, and head against a measuring board or a wall to which a special paper measuring scale has been attached with adhesive tape. The child's arms are at the side in a natural position and the head is held so that the visual axis is horizontal. A square, consisting of two flat pieces of wood joined at right angles, or a flat block or chalk box, is brought down firmly two or three times on the head of the child with sufficient force for the examiner to feel the impact, and the reading is taken from the last position.

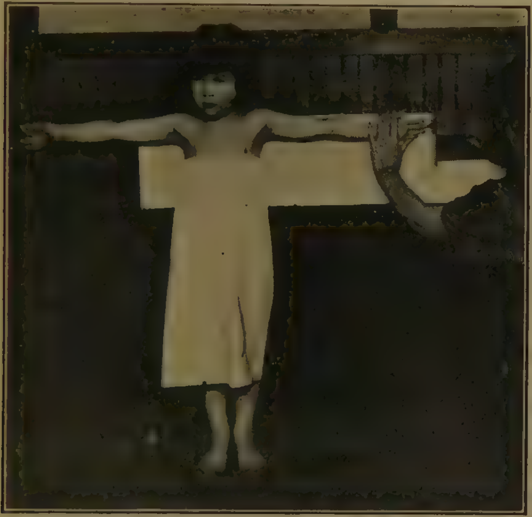


FIG. 6. THE SPAN OF ARMS ALMOST EQUALS THE HEIGHT

For taking weight the ordinary beam scales with the results expressed in pounds and ounces are preferable to the spring scales. The base of the scales is held steady by the examiner in order to eliminate any movement of the scales before the measurement is taken.

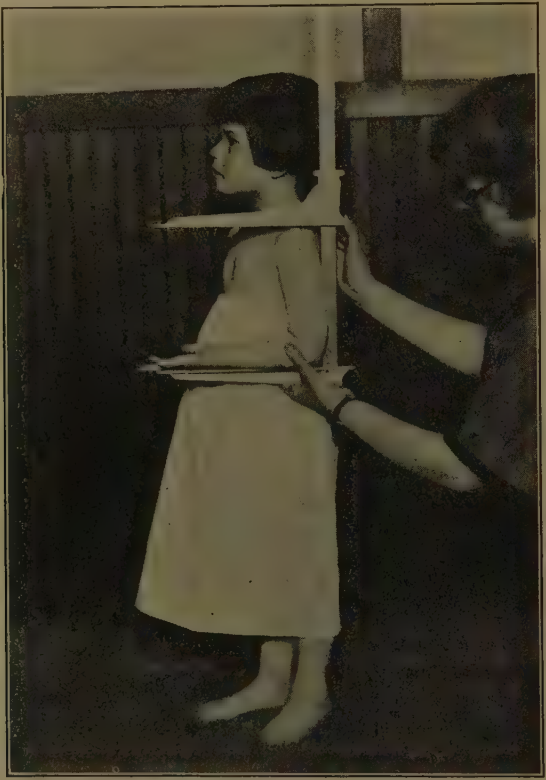


FIG. 7. CALIPERS ARE USED FOR MEASURING VARIOUS PARTS OF THE BODY.

A copy of the physical measurements is sent to the child's parents from time to time, together with the standards for the principal traits and a brief explanation of the significance of the measurements. An effort is also made to interest the child in its growth.

Observational Notes.—The following notes taken from the examiner's log book illustrate some typical situations as they arise in this phase of the work.

H.B. Age 2

Fine coöperation. Went through the measurements cheerfully and with confidence. Can not unbutton or button clothes or unlace or lace shoes. Seems to expect everything to be done for him.

W.L. Age 3

Her first measurement and first time in this room. Good coöperation in height measurement; somewhat afraid in weight measurement. No objection to undressing: helped button clothes. Became interested in tape measure; had evidently played with a similar one before, as she reached for it as soon as it was produced. Was allowed to play with it a little. Became talkative toward end, but offered a little resistance to some measurements, so they were omitted this time.

S.J. Age 4

Enjoyed the measurements thoroughly. Did not object to being undressed, but asked if any one could come in. Said she didn't want any one else to see how big she was. Buttoned her clothes and put them on herself. Put on her shoes, said, "Now I need a buttonhook" and buttoned them without help when provided with the hook. Asked what each instrument was for.

Growth Norms

All physical measurements in the laboratories are taken in metric units. For comparative purposes and for the convenience of the reader, the measurements on the sample record card, the norms, and other tabulated data have been translated into the English units of measure. For those who wish to make comparisons with other weight norms in which clothing is included, 3.5 per cent should be added for ordinary clothing without coats or shoes. Our results show that the clothing weighs on the average from 1 to 1¾ pounds for children between the ages of two and six years.

Table I. Norms for Height and Weight for 21,442 Iowa Children from 2 to 6 Years, 1918

Age, months	10,802 Boys		10,640 Girls	
	Height, inches	Weight, pounds	Height, inches	Weight, pounds
24–25	33.8	26.4	33.1	25.0
25–26	34.1	27.0	33.3	25.2
26–27	34.3	27.1	33.8	25.8
27–28	34.6	27.2	34.0	26.2
28–29	34.7	27.7	34.2	26.4
29–30	34.9	28.1	34.6	26.9
30–31	35.2	28.4	34.9	27.4
31–32	35.9	29.2	35.3	27.8
32–33	36.0	29.7	35.5	27.9
33–34	36.2	29.6	35.6	28.1
34–35	36.4	30.1	35.9	28.6
35–36	36.5	30.2	36.0	28.8
3 36–37	36.9	30.8	36.4	29.4
37–38	37.1	30.8	36.6	29.7
38–39	37.3	31.3	37.0	30.2
39–40	37.6	31.6	37.1	29.9
40–41	37.7	31.8	37.2	30.3
41–42	37.9	32.2	37.5	31.0
42–43	38.4	32.9	37.9	31.2
43–44	38.6	33.1	38.0	31.4
44–45	38.9	33.2	38.3	31.5
45–46	39.1	34.0	38.5	32.0
46–47	39.1	33.8	38.7	32.5
47–48	39.4	34.2	38.7	32.2
4 48–49	39.3	35.0	39.3	33.1
49–50	39.7	34.4	39.3	33.3
50–51	40.0	34.9	39.6	33.6
51–52	40.0	35.1	39.7	33.7
52–53	40.2	35.5	39.8	33.9
53–54	40.4	35.9	40.0	34.0
54–55	40.6	35.8	40.2	34.3
55–56	40.9	36.0	40.5	34.8
56–57	41.3	36.9	40.9	35.4
57–58	41.4	37.1	41.0	35.3
58–59	41.5	37.4	41.4	36.3
59–60	41.7	37.3	41.4	36.1
5 60–61	41.9	37.9	41.5	36.5
61–62	42.0	38.1	41.7	37.3
62–63	42.4	38.6	41.5	36.7
63–64	42.1	38.1	41.9	36.6
64–65	42.2	38.6	42.2	37.6
65–66	42.8	39.1	42.3	37.6
66–67	43.1	40.2	42.1	38.5
67–68	43.2	40.4	42.6	38.7
68–69	43.5	40.9	42.8	40.0
69–70	43.9	41.6	43.6	40.3
70–71	44.1	41.1	43.4	39.5
6 71–72	44.1	40.9	43.2	40.0

Height and Weight

Table I gives the average heights and average nude weights by months of 21,442 Iowa children, 10,802 boys and 10,640 girls, between two and six years, of whom 82.2 per cent were of native-born parents. These norms are the result of the Children's Year compaign in 1918, during which the Federal Children's Bureau and the Iowa Child Welfare Research Station coöperated in securing the measurements. They are slightly higher than the norms issued by the Federal Children's Bureau.

To use the norms in Table I the child's height should be found. The corresponding weight for this height is approximately what the American child should weigh, regardless of age, since age has little or no influence on weight during these earlier years. That is, children of three, four, or even five years, and of the same height, will, as a rule, weigh the same. A difference of 2 or 3 pounds from the norm is not considered significant unless the child shows other signs of malnourishment.

Sixteen Measurements of the Laboratory Children

The results of the measurements in our preschool laboratory give a comprehensive picture of the growth of various parts of the body. The number of children is small, but there is a fairly large number of repeated measurements accurately made. The group is a relatively homogeneous one of native-born children from a somewhat favored social class. The children are slightly taller and heavier on the average than the children included in Table I, who are from the entire state of Iowa. The preschool children are therefore slightly above the Federal Bureau standards for children from the entire United States for the ages three and four years, and about equal to the Baldwin-Wood * standards for five and six years. Although it is probable that our preschool measurements are representative for the ages at which they were made, they are not submitted at this time as final standards since we are acquiring more data daily.

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* This table is published in popular form by the American Child Health Association, 370 Seventh Avenue, New York City.

Table II summarizes the measurements for boys and girls of from three to six years at three month intervals.* The average gives the central tendency of the measurements for each trait for each age period, and the standard deviation gives the range of variation of about 70 per cent of the measurements.

The boys exceed the girls at any particular age between three and six years in all measurements except width of hips, which is equal for the two. Boys grow in standing height from 37.6 inches at two years to 45.4 inches at six years. For span of arms the growth is from 36.6 to 44.4 inches, almost the same as in standing height. For weight the increase is from 32.0 pounds at two years to 44.1 pounds at six years. The head grows only 0.6 inch in circumference and considerably less in length and width. The increase in these measurements is similar for girls.

The increments of growth from year to year show that young children grow fairly uniformly in the majority of the physical traits studied. The boys grow on an average 0.6 inch in height every three months and the girls 0.5 inch; in weight the average increase for the boys is 1 pound and for the girls 0.9 pound. The greatest percentage of growth from three to six years for these children is in weight, in which there is an increase of 37.8 per cent for boys and 33.1 per cent for girls. In standing height the boys gain 20.7 per cent and the girls 18.1 per cent, while in span of arms the boys gain 21.3 per cent, and the girls 19.3 per cent. In the other physical traits the gains are very similar. While the boys gain more in actual growth

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* Table II will be found on an insert facing page 37.

Table II.—Averages by Age and Sex of Measurements of 16 Physical Traits of Children in the Preschool Laboratories

AGE		HEIGHT				HEAD						SHOULDERS		ARMS										CHEST						HIPS		WEIGHT	
Years Months	Children	Standing	Standard Deviation	Sitting	Standard Deviation	Diameter, Anterior Posterior	Standard Deviation	Diameter, Transverse	Standard Deviation	Circumference	Standard Deviation	Width	Standard Deviation	Span	Standard Deviation	Shoulder-Elbow, left	Standard Deviation	Shoulder-Elbow, right	Standard Deviation	Elbow-Finger Tips, left	Standard Deviation	Elbow-Finger Tips right	Standard Deviation	Width	Standard Deviation	Depth	Standard Deviation	Circumference	Standard Deviation	Width	Standard Deviation		Standard Deviation
		Inches		Inches		Inches		Inches		Inches		Inches		Inches		Inches		Inches		Inches		Inches		Inches		Inches		Inches		Inches		Pounds	
BOYS (2,528 MEASUREMENTS)																																	
3–0	8	37.[illegible]	1.5	22.3	.9	6.6	.2	5.5	.2	20.0	.4	9.1	.4	36.6	1.5	7.8	.3	7.8	.3	10.2	.4	10.2	.4	6.7	.2	5.0	.3	20.0	.8	7.0	.2	32.0	2.6
3–3	10	38.2	1.3	22.6	.6	6.6	.2	5.5	.2	20.0	.4	9.3	.4	37.4	1.3	8.1	.4	8.1	.4	10.4	.4	10.4	.4	6.7	.3	5.1	.2	20.4	.8	7.2	.3	32.8	2.6
3–6	12	38.7	1.1	22.7	.6	6.6	.2	5.6	.2	20.0	.4	9.3	.3	38.0	.8	8.1	.3	8.1	.3	10.5	.3	10.5	.3	6.7	.2	5.1	.2	20.4	.6	7.3	.3	34.4	2.6
3–9	10	39.[illegible]	1.1	23.1	.6	6.7	.2	5.6	.2	20.1	.5	9.4	.2	38.4	.9	8.2	.3	8.2	.3	10.7	.3	10.7	.3	6.8	.2	5.1	.2	20.4	.8	7.4	.4	35.7	3.7
4–0	8	40.1	1.1	23.1	.7	6.7	.2	5.6	.1	20.1	.5	9.5	.3	39.3	.7	8.3	.3	8.3	.3	10.7	.1	10.7	.1	6.9	.2	5.1	.2	20.5	.7	7.4	.3	36.5	3.7
4–3	6	41.0	.8	23.7	.5	6.8	.2	5.6	.2	20.2	.6	9.7	.2	40.0	.0	8.7	.2	8.7	.2	11.0	.4	11.0	.4	6.9	.3	5.2	.1	20.8	.6	7.4	.3	37.3	3.1
4–6	9	42.4	.8	24.3	.4	6.9	.2	5.6	.2	20.3	.4	10.0	.3	41.7	1.1	8.9	.2	8.9	.2	11.4	.3	11.4	.3	7.1	.3	5.3	.2	21.3	.4	7.7	.2	39.2	1.3
4–9	7	43.2	1.1	24.4	.6	6.9	.2	5.6	.2	20.4	.4	10.1	.3	42.2	1.2	9.1	.3	9.1	.3	11.6	.3	11.6	.3	7.1	.2	5.4	.2	21.4	.4	7.7	.2	40.1	1.6
5–0	9	43.3	.9	24.2	.9	6.9	.2	5.6	.2	20.4	.5	10.1	.2	42.2	1.1	9.1	.3	9.1	.3	11.6	.3	11.6	.3	7.2	.2	5.4	.2	21.4	.5	7.7	.3	41.2	2.2
5–3	17	43.7	1.1	24.6	.9	7.0	.2	5.6	.2	20.5	.9	10.1	.4	42.8	1.3	9.2	.3	9.2	.3	11.7	.4	11.7	.4	7.2	.3	5.4	.3	21.8	.9	7.8	.4	41.7	4.0
5–6	21	44.3	1.3	25.1	.9	7.0	.2	5.6	.2	20.7	.9	10.2	.5	43.5	1.4	9.3	.3	9.3	.3	11.9	.4	11.9	.4	7.4	.4	5.5	.3	22.1	.9	7.8	.5	42.3	3.9
5–9	18	44.9	1.2	25.4	.9	7.0	.2	5.7	.2	20.7	.9	10.3	.4	43.7	1.3	9.3	.3	9.3	.3	11.9	.4	11.9	.4	7.4	.4	5.6	.3	22.4	.9	7.9	.4	43.4	3.7
6–0	23	45.4	1.5	25.2	1.0	7.0	.2	5.7	.2	20.7	.6	10.3	.4	44.4	1.7	9.5	.4	9.5	.4	12.2	.5	12.2	.5	7.4	.3	5.6	.3	22.4	.6	8.0	.4	44.1	3.2
GIRLS (3,024 MEASUREMENTS)																																	
3–0	9	37.6	.7	22.2	.4	6.5	.2	5.3	.2	19.5	.5	9.1	.4	36.3	.6	7.6	.2	7.6	.2	9.8	.2	9.8	.2	6.5	.3	4.8	.2	19.7	.9	7.0	.3	31.7	2.2
3–3	13	37.8	.9	22.2	.6	6.5	.2	5.4	.2	19.5	.4	10.0	.4	36.3	1.2	7.7	.4	7.7	.4	10.0	.2	10.0	.2	6.5	.3	4.8	.2	19.8	.9	7.1	.4	32.2	3.6
3–6	16	38.3	1.1	22.4	.6	6.5	.2	5.4	.2	19.5	.5	9.3	.3	37.6	1.1	7.9	.3	7.9	.3	10.2	.3	10.2	.5	6.6	.3	4.9	.2	19.9	.9	7.2	.4	32.8	2.9
3–9	13	39.2	1.1	22.6	.6	6.5	.2	5.4	.2	19.6	.5	9.4	.3	38.0	1.0	8.1	.2	8.1	.2	10.4	.3	10.4	.3	6.7	.3	4.9	.2	19.9	.7	7.3	.4	34.0	2.6
4–0	11	40.0	1.1	23.2	.4	6.6	.2	5.4	.2	19.6	.6	9.4	.3	38.7	1.2	8.2	.3	8.2	.3	10.6	.2	10.6	.2	6.7	.3	5.0	.2	20.0	1.0	7.4	.4	35.1	2.4
4–3	14	40.7	1.1	23.4	.6	6.6	.2	5.4	.2	19.6	.5	9.5	.3	39.3	1.0	8.5	.3	8.5	.3	10.7	.3	10.7	.3	6.8	.3	5.0	.2	20.4	.9	7.4	.3	36.6	3.3
4–6	13	41.7	.7	23.7	.7	6.6	.2	5.4	.2	19.7	.5	9.7	.3	40.3	.6	8.6	.2	8.6	.2	10.9	.2	10.9	.2	6.9	.2	5.0	.2	20.6	.7	7.5	.4	37.7	3.3
4–9	8	41.9	1.1	23.8	.7	6.6	.2	5.4	.2	19.7	.4	11.1	.2	40.4	1.1	8.8	.2	8.8	.2	11.1	.2	11.1	.2	7.0	.3	5.1	.2	20.8	.7	7.6	.3	38.4	2.6
5–0	16	42.4	1.2	24.2	.7	6.6	.2	5.4	.2	19.7	.4	9.8	.4	40.7	.9	8.9	.3	8.9	.3	11.2	.3	11.2	.3	7.0	.3	5.2	.2	20.8	.6	7.8	.3	38.8	3.5
5–3	20	43.2	1.4	24.5	.9	6.7	.2	5.4	.2	19.9	.6	10.0	.4	41.9	1.3	9.1	.3	9.1	.3	11.4	.4	11.4	.4	7.1	.3	5.3	.2	21.3	.7	7.8	.4	40.1	3.7
5–6	20	43.6	1.5	24.5	.9	6.7	.2	5.5	.2	19.9	.4	10.1	.3	42.6	1.5	9.1	.3	9.1	.3	11.5	.5	11.5	.5	7.1	.3	5.4	.2	21.6	.9	7.9	.3	40.8	4.2
5–9	18	44.2	1.5	24.8	1.0	6.8	.2	5.6	.2	20.0	.4	10.2	.5	43.3	1.6	9.3	.5	9.3	.5	11.7	.6	11.7	.6	7.2	.3	5.5	.3	21.9	1.1	8.0	.4	41.2	3.7
6–0	18	44.4	1.8	24.8	1.2	6.8	.2	5.6	.2	20.0	.4	10.2	.6	43.3	1.7	9.3	.4	9.3	.4	11.7	.6	11.7	.6	7.2	.3	5.5	.4	22.0	1.0	8.0	.5	42.2	4.2

Table VIII. — Total and Partial Correlations Among Mental Traits with Probable Errors *

TEST	CHRONOLOGICAL AGE	STANFORD-BINET MENTAL AGE	DETROIT KINDERGARTEN			CARD SORTING			GODDARD FORM BOARD			PORTEUS MAZE			THREE-HOLE			PERFORATION			MONTESSORI FRAMES			TRACING PATH			PICTURE MEMORY			PICTURE COMPLETION			COLOR DISCRIMINATION			COLOR CARD SORTING			PICTURE VOCABULARY			WEIGHT CONCEPT			NUMBER CONCEPT		
		Zero Order	Zero Order	Chronological Age Constant	Mental Age Constant	Zero Order	Chronological Age Constant	Mental Age Constant	Zero Order	Chronological Age Constant	Mental Age Constant	Zero Order	Chronological Age Constant	Mental Age Constant	Zero Order	Chronological Age Constant	Mental Age Constant	Zero Order	Chronological Age Constant	Mental Age Constant	Zero Order	Chronological Age Constant	Mental Age Constant	Zero Order	Chronological Age Constant	Mental Age Constant	Zero Order	Chronological Age Constant	Mental Age Constant	Zero Order	Chronological Age Constant	Mental Age Constant	Zero Order	Chronological Age Constant	Mental Age Constant	Zero Order	Chronological Age Constant	Mental Age Constant	Zero Order	Chronological Age Constant	Mental Age Constant	Zero Order	Chronological Age Constant	Mental Age Constant	Zero Order	Chronological Age Constant	Mental Age Constant
Chronological Age		.86	.76		.13	.83		.47	.51		.21	.64		.11	.74		.18	.39		.0	.72		.33	.63		.25	.61		.27	.35		−.19	.63		.02	.69		.31	.72		.33	.45		.0	.69		.14
Stanford-Binet Mental Age	.03		.84	.57		.79	.28		.49	.11		.69	.37		.79	.45		.45	.25		.69	.21		.62	.18		.58	.13		.51	.42		.72	.45		.67	.20		.70	.22		.52	.29		.75	.42	
Detroit Kindergarten	.04	.03				.74	.32	.23	.45	.11	.08	.64	.31	.15	.71	.35	.14	.34	− 07	−.08	.59	.09	.0	.55	.12	.06	.59	.25	.25	.51	.39	.17	.68	.40	.20	.68	.32	.28	.75	.44	.41	.47	.23	.08	.78	.54	.41
Card Sorting	.03	.04	.05						.41	−.03	.05	.56	.08	.04	.68	.18	.14	.42	19	.12	.74	.38	.43	.50	−.05	.03	.68	.39	.44	.44	.28	.07	.62	.24	.08	.81	.58	.61	.74	.37	.43	.40	06	−.02	.58	.01	−.04
Goddard Form Board	.08	.08	.08			.09						.73	.61	.63	.51	.24	.24	.08	−.15	−.18	.33	−.06	−.01	.34	.02	.05	.22	−.14	−.09	.18	.0	−.09	.15	− 26	−.34	.25	−.16	.05	.32	−.09	− 04	−.03	−.33	−.38	.26	−.15	−.18
Porteus Maze	.06	.05	.06			.07			.05						.66	.37	.26	.14	−.15	.26	.34	−.23	.28	.62	.36	.34	.50	.18	.17	.29	.10	−.09	.49	.14	−.02	.48	.07	.03	.43	−.06	.11	.31	.03	−.08	.54	.18	.04
Three Hole	.05	.04	.05			.06			.08			.06						.48	.31	.23	.48	−.10	−.15	.66	.38	37	.47	.05	.04	.34	.12	−.12	.59	.24	−.05	.64	.26	.24	.66	.28	.26	.41	.13	.0	.56	.10	.08
Perforation	.09	.08	.09			.09			.10			.10			.08						.30	.02	.03	.26	.02	.03	.22	−.03	−.06	.23	.10	.0	.37	.18	.08	.41	.22	.17	.47	.30	24	.38	.25	.19	.24	− 05	.17
Montessori Frames	.05	.05	.07			.05			.09			.09			.08			.10						.50	.09	.13	.36	−.15	−.07	.42	.25	.11	.41	−.08	−.18	.55	.11	.17	.50	−.03	.03	.30	−.03	−.09	.55	.11	.07
Tracing Path	.06	.07	.07			.08			.09			.06			.06			.10			.08						.49	.17	.21	.23	.0	−.12	.65	.41	.37	.61	.31	.34	.53	.13	.17	.27	−.01	−.07	.62	.33	.30
Picture Memory	.07	.07	.07			.06			.10			.08			.08			.10			.09			.08						.18	.04	.15	.58	.31	.28	.66	.41	.45	.61	.30	.35	.33	.08	.04	.65	.39	.40
Picture Completion	.09	.08	.08			.09			.10			.10			.09			.10			.09			.10			.10						.27	.07	−.15	.23	−.02	−.17	.36	.17	.02	.27	.13	.01	.40	.23	.03
Color Discrimination	.06	.05	.06			.06			.10			.08			.07			.09			.09			.06			.07			.10						.61	.32	.26	.72	.49	.43	.32	.05	−.09	.68	.43	.30
Color Card Sorting	.06	.06	.06			.04			.10			.08			.06			.09			.07			.07			.06			.10			.07						.71	.43	.46	.42	.18	.13	.58	.20	.16
Picture Vocabulary	.05	.05	.05			.05			.09			.09			.06			.08			.08			.08			.07			.09			.05			.05						.41	.14	.08	.60	.21	.17
Weight Concept	.08	.08	.08			.09			.11			.10			.09			.09			.10			.10			.09			.10			.09			.09			.09						.51	.31	.22
Number Concept	.05	.05	.04			.07			.10			.07			.07			.10			.07			.06			.06			.09			.06			.07			.07			.08					

* The probable error, given in the lower triangle, may be either plus or minus.

than the girls from three to six years, the girls have attained at three years in nearly all of the traits a greater percentage of their measurements at six years than the boys. Our work with children of all ages also shows that at six years the girls have reached a higher percentage of their ultimate stature and other measurements than the boys.

An inspection of the standard deviations for the small groups in the table shows that in general the boys have higher deviations than the girls. When the deviations are multiplied by 100 and the product divided by the average, a percentage is obtained which is called the Pearson coefficient of variability. The coefficients of variability for the boys and girls for each half year from three to six years for each trait show that the girls are more variable in physical growth than the boys in a majority of the traits.

Growth of the Body and Its Parts

In the last analysis, problems of growth are largely individual problems. Is the child growing proportionately for its age, sex, nationality, social status, and previous increments of growth? The individual curves and profiles give the best picture of successive stages of growth. These may be compared with the general averages to determine the size of the individual compared with a group of similar children. While averages furnish a gross means of comparing groups of children or of an individual with the group, the significant problem, however, for parents, physicians, psychologists, and teachers is always that of individual development.

Individual Growth Curves

The individual curves, presented in Figure 8, for growth in height and weight illustrate the growth of a boy and of a girl from three to six years. The height of the boy's curve shows that the boy is slightly shorter than the girl, but a trifle heavier during these years.

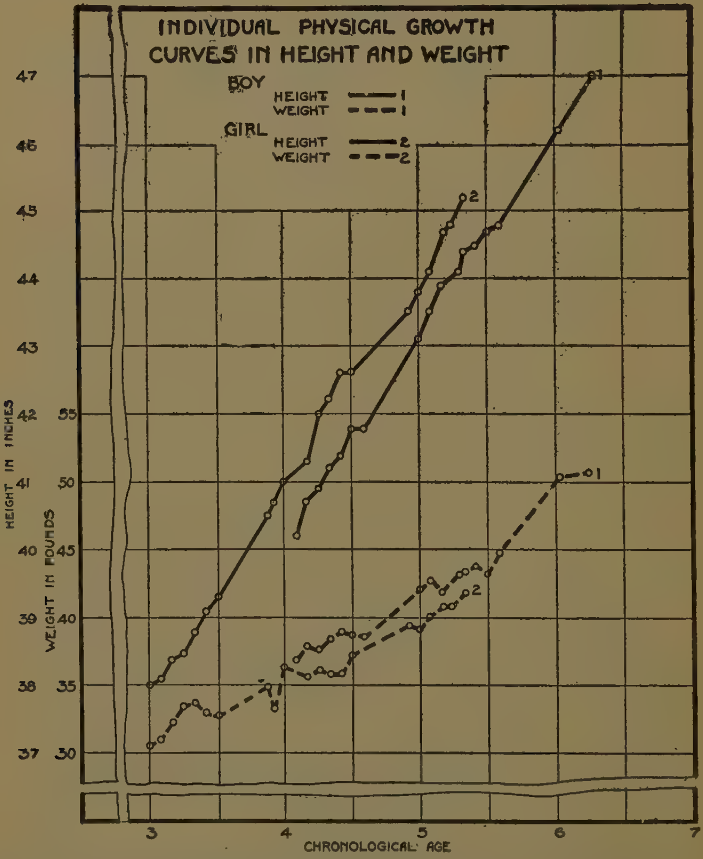


FIG. 8. THESE CURVES SHOW THE RESPECTIVE GAINS IN HEIGHT AND WEIGHT OF A BOY AND A GIRL.

The irregularity of the weight curves indicates that there is more fluctuation in weight than in height, with occasional decrease in weight from month to month. When compared with the standards in Table II, the boy and girl are found to be taller than the average at each age. The boy's weight is normal for his height, but the girl is a few pounds underweight for her height, and she has maintained this position consistently for some time.

Individual Growth Profiles

The most significant measures of individual development are the actual increments of growth for each child for each trait; these are expressed as percentages of gain over the first measurement and plotted graphically as individual profiles of growth in each trait. Figure 9 gives

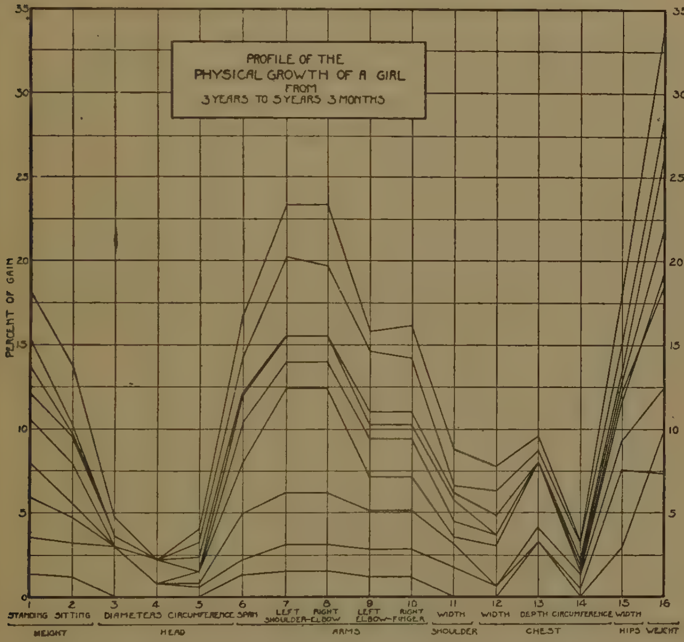
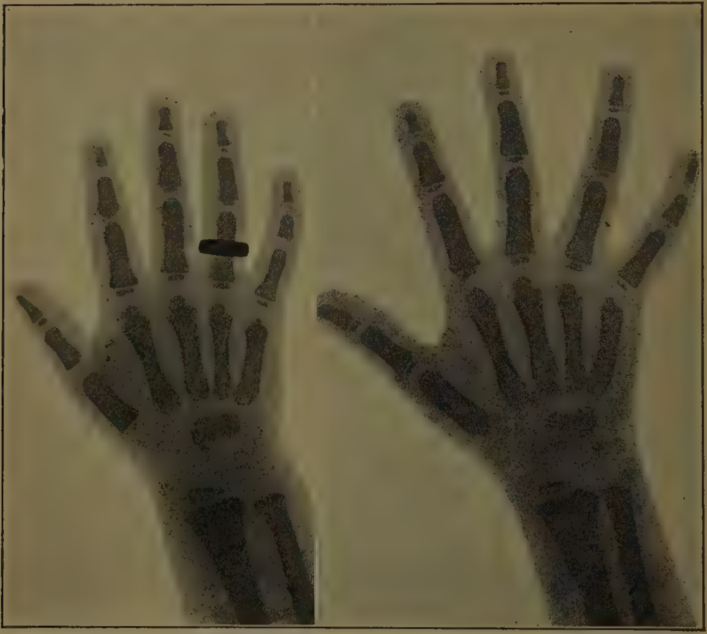
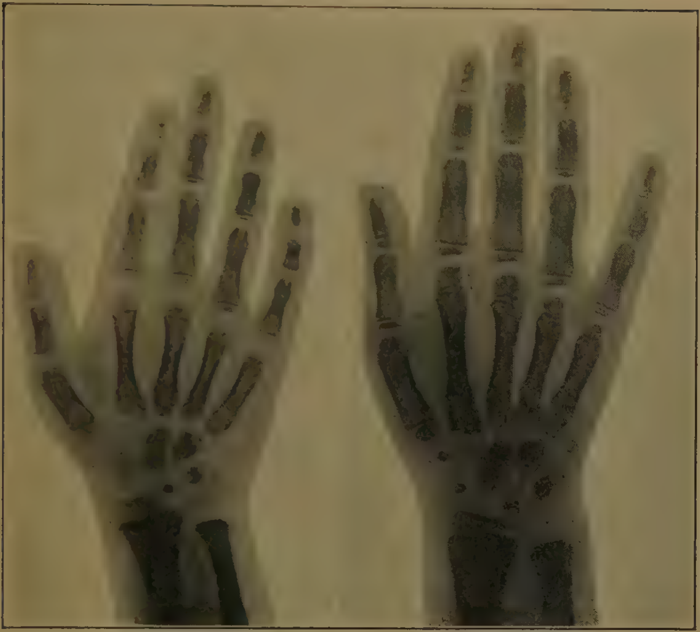


FIG. 9. THE INDIVIDUAL LINES GIVE AN IDEA OF THE VARYING GAINS IN THE PHYSICAL TRAITS OF A GIRL MEASURED FROM THREE YEARS TO FIVE YEARS THREE MONTHS.



FIGS. 10, 11. LEFT—ROENTGENOGRAM OF THE WRIST BONES OF A CHILD OF TWO YEARS. TWO BONES ARE VISIBLE. RIGHT—ROENTGENOGRAM OF THE WRIST BONES OF A CHILD OF THREE YEARS. FOUR BONES HAVE APPEARED.

at a glance the relative percentages of growth of one child in sixteen physical traits, at three-month intervals, with the first measurement of each trait considered 100 per cent. This individual profile of physical development illustrates relative growth in the various physical traits at these early ages and the changes in growth with age. The greatest gains in percentage of growth for every three months are found in standing height (trait number 1), length of the upper arms (left 7 and right 8), width of hips (15), and weight (16). The smallest gains are in the diameters of the head.



FIGS. 12, 13. LEFT—ROENTGENOGRAM OF THE WRIST BONES OF A CHILD OF FOUR YEARS. FOUR BONES HAVE MADE THEIR APPEARANCE. RIGHT—ROENTGENOGRAM OF THE WRIST BONES OF A CHILD OF FIVE YEARS. SIX BONES HAVE MADE THEIR APPEARANCE. THESE BONES WILL GROW IN SIZE UNTIL THE CHILD IS IN ITS LATER TEENS. DURING ADOLESCENCE TWO MORE BONES WILL DEVELOP.

Plotting the individual profile is a practical and valuable method for recording growth, since a composite picture of consecutive measurements is always at hand for comparison with the norms that show increments of growth for the various traits. If the percentages of gain begin to drop below the child's normal rate at that age and time of year, special examinations may be made and remedial measures taken. This type of profile record may be used in any kindergarten or first grade room with practical advantage since the teacher, parents, or physician can see at a glance how the child is growing, and may take measures to insure proper growth.*

Anatomical and Physiological Ages

Children of the same chronological or actual ages may differ considerably in their stages of physical development. Some children are more mature physiologically than others. Ossification is further advanced and the more general motor functions are accelerated; more of the final stature has been attained and more teeth have erupted. Our data indicate that the larger children apparently are older in their anatomical structures and in their physiological functions than the smaller children of the same age, race, and social status. A child may be more accelerated in one of these phases of growth than in others.

Growth of Carpal Bones

Data that indicate the anatomical status are obtained by roentgenograms of the bones of each child's wrists. The exposed surface area of each wrist bone is measured by tracing the outline with a very accurate instrument designed for this purpose, and expressing the result as a total in square millimeters or decimals of a square inch, or as an index in relation to the size of the wrist, the hand, or other measurements.

Figures 10, 11, 12, and 13 show very clearly the usual increase, with chronological age, in the ossification of the wrist bones. On the average, the bones increase in number from two or three bones at two years to six or seven bones at six years. The eighth bone usually appears between the ages of twelve and fifteen. The actual size of the bones for a particular child also increases with age.

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* Paper measuring scales, growth norms, record blanks, and profile forms may be secured through the writers.

Individual Differences in Development

Since the children in our laboratories represent a fairly homogeneous group, the range of individual differences in all traits is not so great as it would be with a group of children of varied nationalities and more varied social conditions. In organizing the three groups for our preschool laboratories we have attempted as far as possible to group children of the same relative stages of development. We have also not relied on chronological age or mental age alone, but have considered the child's degree of physical and social maturity. As has been explained in Chapter I, the children are assigned to the three groups after a brief examination. Corroboration of the fact that this classification corresponds to real differences in physical development is obtained from the physical measurements of children in the various groups. For example, the range of heights for the first group of children is between 34 and 39 inches, for the second group between 39 and 44 inches, and for the third group between 41 and 45 inches.

The individual differences in anatomical and physiological ages among our children of the same chronological age will be noted in this series of measurements for two tall

COMPARISON OF MEASUREMENTS OF TALL AND SHORT GIRLS

Traits	Tall		Short	
	E.G.	B.H.	L.S.	C.T.
Height, inches	39.2	39.0	36.6	37.0
Weight, pounds	30.9	34.6	28.7	30.0
Width of Shoulders, inches	9.1	9.8	9.0	9.1
Width of Hips, inches	7.5	7.3	7.0	7.2
Circumference of Chest, inches	18.4	20.3	19.1	19.3
Number of Wrist Bones, Right	4	3	2	3
Number of Wrist Bones, Left	4	3	2	3
Area of Wrist, Right, in square inches	0.085	0.087	0.051	0.064
Area of Wrist, Left, in square inches	0.088	0.087	0.054	0.064

girls, E.G. and B.H., and two short girls, L.S. and C.T., all three years and six months of age.

In almost all traits, including the exposed area of the wrist bones, the measurements for these two tall girls are in excess of those for the short girls. Of the tall girls, E.G. is relatively lighter and of smaller build than B.H. Of the short girls, L.S. is slightly smaller than C.T. The total exposed area of the wrist bones shows a direct relationship with height; it is less for the smaller girls.

Development of Teeth

The roentgenograms of the side of the face give another good indication of the child's stage of anatomical growth. Figure 14 shows the development of the teeth of a five-year-old girl. The picture gives a fascinating forecast of the future growth and eruption of the teeth, since some of the permanent teeth will not appear through the gums for five or six years. At the age of two years all of the twenty temporary, or deciduous, teeth should be through the gums. Although individual children may deviate one or two years, the order of the eruption of the teeth during the first six years is on the average as follows:

Temporary, or Deciduous, Teeth

Age	
Six months	Central incisors, lowers, followed by uppers
Seven to eight months	Lateral incisors, lowers, followed by uppers
Twelve months	First molars, upper and lower
Fourteen to eighteen months	Cuspids
Twenty to twenty-four months	Second molars

Permanent Teeth

Six years	First molars, lower and upper

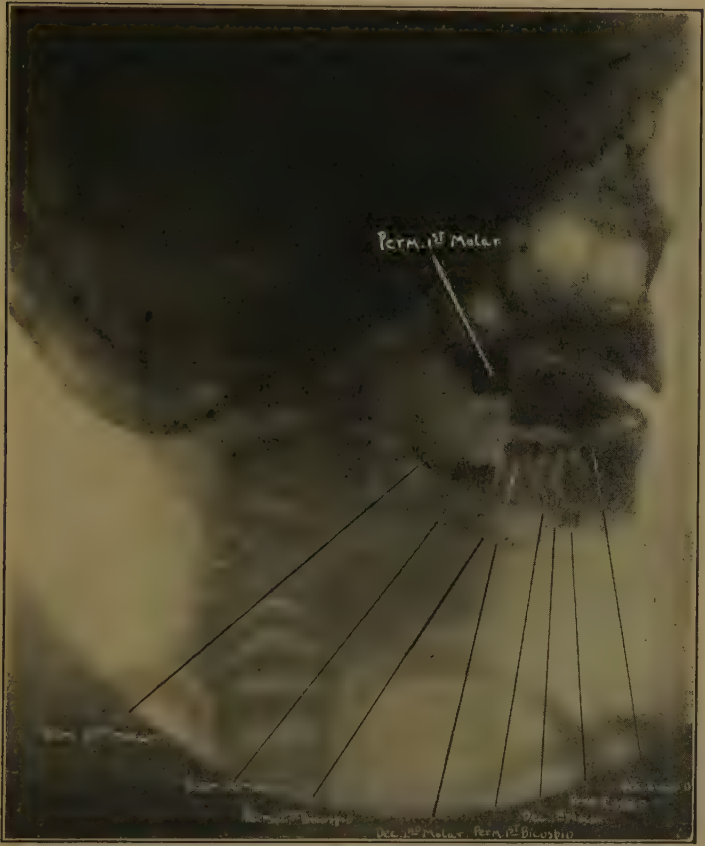


FIG. 14. A PREDICTION FOR THE FUTURE DEVELOPMENT OF THE TEETH. THE PERMANENT TEETH ARE PUSHING OUT THE DECIDUOUS TEETH.

Sex Differences

Sex differences in physical growth, as shown in Table II, are apparent in practically all traits. The boys exceed the girls in standing height, sitting height, arm span, length of upper arm and forearm, circumference of head, circumference of chest, and in weight. Width of shoulders and width of hips are approximately equal for boys and girls for the ages included, and larger for the girls when height and weight are used as the basis for comparison and age is eliminated.

For our group, in which individual consecutive measurements were made, the girls are approximately as heavy for their respective heights as the boys, but shorter and lighter at any particular age. The increments of growth from year to year are slightly larger for the boys than for the girls.

At three years, the girls have reached a higher percentage of their six-year measurements in all of the traits included, but the boys gain more in percentage of growth from three to six years than the girls. Girls are more variable in growth than boys.

The roentgenograms of the wrist show that the girls exceed the boys both as to number of bones and degree of ossification. This acceleration of girls amounts to approximately one year at these ages.

These facts seem to indicate that in these groups of children from two to six years, the girls are further developed physiologically than the boys.

Correlations Between Physical Traits

The degree of correspondence between any two sets of facts may be measured by means of a coefficient of correlation. Statistical methods used in computing this coefficient may be found in Rugg.[118] When the correlation is found to be approximately zero, the two sets of facts are relatively independent of each other. As the coefficient of correlation approaches + 1, the relationship becomes more nearly perfect. As the coefficient approaches — 1, the relationship also nears perfect correspondence, but in the negative sense. For example, if a group of children is measured in height and weight and each child's height is relatively the same amount above or below the average height that its weight is above or below the average weight, a high positive correlation results and there is a high degree of correspondence. The two traits correspond in their relative rates of growth. The probable error of the coefficient of correlation indicates the reliability of the correlation, since the chances are even that the true value of the coefficient is not less than the obtained coefficient minus the probable error, or greater than the obtained coefficient plus the probable error.

Coefficients of correlation were calculated for a group of thirty-six boys and fifty-three girls ranging from two to six years of age, between the traits of height, weight, and exposed area of carpal bones. The exact age at which the roentgenograms were taken was used as the basis for comparison, the height and weight being corrected at the child's prevailing rate of growth to correspond to this exact age. All physical measurements were actually made within two months of the time of the roentgenogram. The correction simply gave more accurately the growth status on the day of the roentgenogram.

Total and Partial Correlations for Height, Weight, and Chronological Age

The coefficient of correlation between height and weight for the boys was found to be +.86 with a probable error of ±.03. For the girls, the coefficient of correlation was +.89 with a probable error of ±.02. This means that the children who are relatively tall are also relatively heavy. The correlation between height and chronological age for the same group of boys was +.92 with a probable error of ±.02, and for the same group of girls +.88 with a probable error of ±.02. These high correlations indicate that the older children are also relatively taller.

The correlation between weight and chronological age for this group of boys was +.77 with a probable error of ±.05 and for the group of girls +.78 with a probable error of ±.04. The older children are also the heavier ones, but the correspondence between weight and age is less close than between height and age.

The children in the groups mentioned above varied in age from two to six years. In order to eliminate as far as possible the influence of chronological age, coefficients of partial correlation were calculated. The results showed that with age constant the coefficients of partial correlation for height and weight were for the boys +.61 and for the girls +.68. That is, growth in weight and in height for these young children go together even when chronological age is eliminated.

Total and Partial Correlations for Height, Weight, Carpal Area, and Chronological Age

For height and carpal bone area the group of boys ranging from two to six years of age had a coefficient of correlation of +.77 ±.05, and the group of girls a correlation of +.83 ±.03. This high correlation is to have been expected since both height and size of wrist bones are factors in anatomical age. The correlation between weight and carpal area for the boys was +.72 ±.05, and for the girls +.81 ±.03. This relation is close, though not quite so close as in the case of height. The correlation between carpal bone area and chronological age was for the boys +.71 ±.06 and for the girls +.80 ±.03. The older children are relatively further along in their anatomical development.

With age constant, the partial correlation for height and carpal bone area was +.42 for the boys and +.45 for the girls.

For weight and carpal bone area with age constant the partial coefficient of correlation was +.37 for the boys and +.49 for the girls. These results show that for these young children the growth in area of the carpal bones is closely related to growth in height and in weight, even when age is eliminated.

For carpal bone area and chronological age with height constant the partial coefficient was for boys +.01 and for girls +.25; with weight constant the partial correlation for boys was +.35 and for girls +.46. This shows that the relation between carpal bone area and chronological age is more influenced by height than by weight.

The correlation between height and carpal bone area, when weight and chronological age were kept constant, was for the boys +.26 and for the girls +.19. The correlation between weight and carpal bone area, when height and chronological age were kept constant, was for the boys +.17 and for the girls +.27. The correlation between carpal bone area and chronological age, when both height and weight were kept constant, was for the boys +.03 and for the girls +.26. This indicates that older children do not have larger wrist bones unless they are also taller and heavier. The correlation between physical and mental traits will be found in Chapter VIII, page 177.

CHAPTER III

MENTAL DEVELOPMENT: EXPERIMENTS IN GENERAL INTELLIGENCE AND LEARNING

In previous studies of the preschool child the questionary and observation methods have been employed almost exclusively, as has been shown in the historical chapter. In fact, it has been argued that it would be impossible to obtain reliable results on such young children by the experimental methods of the psychological laboratory. Three years' experience in the preschool laboratories has demonstrated, however, that the child from two to six is a fertile and satisfactory subject for psychological experimentation.

The Application of Laboratory Methods of Study

The conventionally accepted extreme variability of the young child seems to be a myth. Some children are eccentric and variable in performance just as are some adults. Others are consistent in performance, and their general achievement in other tests and in play activities is predictable.

It is often said that the young child is unable to concentrate and is extremely distractible and susceptible to fatigue. Most of the disabilities attributed to the youth of the subject can be explained on the ground of inadequate motivation. The preschool child is relatively less controlled than is an older child or an adult by such incentives as the desire to make a good score, or to beat one's own or another person's record. Often the method of recording involves concepts of number and quantity that the child has not attained. Even making clock hands go around on an electric counter requires a well-developed appreciation of amounts of space covered, and trying to accomplish a task as quickly as possible makes use of time relationships that are still rudimentary in the preschool child.

The young child must be able to see very concrete results of its efforts, and its performance must be at once intelligible to it, usually in terms of amount done or actual changes wrought. Otherwise the child begins to look at the examiner to see what its success has been and keeps at the performance merely because it wishes to please the examiner. So far we have not found it necessary to appeal to pleasure-pain incentives or to offer artificial rewards, but have arranged the experimental situation so that the child is rewarded by the enjoyment obtained from the activity itself. That instinct which has been termed the pleasure in "being a cause" derives rich satisfaction from making an electric bell ring, punching holes in paper, and filling boxes with cards. Accordingly the time-limit method is employed whenever possible with the directions, "Let's see how much you can do before I tell you it's time to stop."

A great deal depends on the way in which a test is introduced. A child should not be interrupted in the midst of a fascinating occupation, but should be taken when it is ready for some diversion. A little preliminary conversation and the cultivation of proper *rapport* between the child and the examiner are essential in getting the child interested and ready to do its best. It is easy to make the "games" in the examining rooms seem a real privilege and to arouse in the child great eagerness to have a turn at what every one seems to think is such an interesting occupation.

If the task is of such a nature as to make a genuine appeal to the child, no difficulty is experienced in getting it to concentrate and no fatigue is likely to occur during short intervals. In some tests even after two minutes' or five minutes' work the child is still interested and wishes to continue.

One of the chief difficulties noticed in working with the young child is its inability to keep in mind a task that is at all complicated. Just as in the Stanford-Binet test of executing three commissions the child is liable to forget one or more, in sorting cards according to color it is liable to lose sight of the directions to sort by color and to become intent merely upon piling cards into boxes. That this is a defect of memory and not of understanding is shown by the fact that the child can be recalled quickly to the original task by a repetition of the instructions. In experimental work with the young child it is well to study this memory factor independently of the ability to understand and execute a task involving a specific function. Again it is advisable to have nothing in sight except the necessary material, as the child is interested in everything new and is inclined to investigate, thus using up a good deal of time before it is possible to get back to the test itself.

The Scope of the Problems

The chief problem of the laboratory has been the investigation of special mental traits and abilities and the study of the development of these abilities in the same child throughout a number of years. There are, of course, very few standardized tests for the preschool age. Tests of the simpler processes in use in the psychological laboratories for adults are inapplicable because they require complicated apparatus that distracts the attention of the child or presents a task too difficult for the child to comprehend and execute. Accordingly the most fruitful method was found to be that of observing the occupations the child enjoyed in the group room, and of devising experiments that analyze similar functions and afford the same satisfactions.

General Intelligence

Nothing is of greater importance in the educational and social treatment of a young child than an early determination of its general intelligence, and yet nothing is more difficult to obtain. It is possible to make a fair medical examination without the active coöperation of the child. Many of the existing intelligence tests for young children cannot be administered, however, unless the child speaks freely. The Stanford-Binet [135] test, which has become a standard means of measuring intelligence throughout the school years, requires five verbal responses at three years and four such responses at four years, thereby greatly limiting its usefulness with young children who are too shy to speak or are handicapped by speech difficulties. Several other scales have been devised to provide for non-verbal responses. The Detroit kindergarten test [3] was used in this study to supplement the Stanford-Binet as a test of the general mental status of the group.

Stanford-Binet Intelligence Test

By way of analysis of the Stanford-Binet tests, it is of considerable interest to note the distribution of the successes of these 105 children among the various tests of the scale. The tests given the preschool children were those for years III to XII:

STANFORD-BINET TESTS

Year III:

1. Points to parts of body
2. Names familiar objects
3. Pictures, enumeration or better

STANFORD-BINET TESTS—*Continued*

4. Gives sex
5. Gives last name
6. Repeats 6 to 7 syllables

Year IV:

1. Compares lines
2. Discrimination of forms
3. Counts 4 pennies
4. Copies square
5. Comprehension, first degree
6. Repeats 4 digits

Year V:

1. Comparison of weights
2. Colors
3. Æsthetic comparison
4. Definitions, use or better
5. Patience, or divided rectangle
6. Three commissions

Year VI:

1. Right and left
2. Mutilated pictures
3. Counts 13 pennies
4. Comprehension, second degree
5. Coins
6. Repeats 16 to 18 syllables

Year VII:

1. Fingers
2. Pictures, description or better
3. Repeats 5 digits
4. Ties bow knot
5. Gives differences
6. Copies diamond

Year VIII:

1. Ball and field
2. Counts 20-0
3. Comprehension, third degree
4. Gives similarities, two things
5. Definitions, superior to use
6. Vocabulary, 20 words

Year IX:

1. Date
2. Weights
3. Makes change
4. Repeats 4 digits backwards
5. Three words
6. Rimes

Year X:

1. Vocabulary, 30 words
2. Absurdities
3. Designs
4. Reading and report
5. Comprehension, fourth degree
6. 60 words

Year XII:

1. Vocabulary, 40 words
2. Abstract words
3. Ball and field
4. Dissected sentences
5. Fables
6. Repeats 5 digits backwards
7. Pictures, interpretation
8. Gives similarities, three things

Analysis of Individual Tests.—Table III shows the percentage of children at each age who passed each test. The first test at year III (pointing to nose, eyes, mouth, hair) is passed by all the two-year-olds as well as by all the children of the higher ages. The second test (naming familiar objects) is passed by a large proportion of two-year-olds (89 per cent). The most difficult test of this year is the sixth (repeating six or seven syllables), for which it is always hard to get a young child's coöperation.

At year IV almost all our four-year-olds pass the first test (comparing lines), the second (discriminating forms), and the fifth (comprehending, first degree); but the fourth (copying the square) is passed by only 24 per cent of our superior four-year-olds. This test should probably be located higher on the scale. At year V almost all the five-

TABLE III. — SUCCESSES IN STANFORD-BINET TESTS OF 105 CHILDREN

AGE		2 YEARS	3 YEARS	4 YEARS	5 YEARS	6 YEARS
CHILDREN		9	39	21	28	8
		SUCCESSES				
Year	Test	Per Cent	Per Cent	Per Cent	Per Cent	Per Cent
III	1	100	100	100	100	100
	2	89	95	100	100	100
	3	33	79	100	100	100
	4	33	74	100	100	100
	5	67	79	100	100	100
	6	11	72	95	100	100
IV	1	11	59	90	93	100
	2		33	95	100	100
	3		15	62	100	89
	4		8	24	93	89
	5		51	95	100	100
	6		13	57	93	89
V	1		13	48	96	75
	2		8	48	71	75
	3		23	57	79	100
	4		18	57	100	100
	5		21	43	79	100
	6		33	52	89	89
VI	1		10	33	54	89
	2		5	33	71	89
	3		3	14	57	63
	4		5	29	71	100
	5		8	10	61	38
	6			19	64	63
VII	1				29	38
	2		5	10	75	100
	3			5	50	50
	4			5	29	25
	5		3	10	50	89
	6				14	50
VIII	1				25	25
	2				4	
	3				32	50
	4				21	25
	5			5	43	50
	6				11	25
IX	1					
	2					
	3					
	4					
	5				7	25
	6					
X	1					13
	2					
	3					
	4					13
	5					
	6					
XII	1					
	2				4	
	3					
	4					
	5					
	6					
	7					
	8					

year-olds pass the first (comparing weights) and the fourth (defining by use). The hardest test at year VI was the fifth (identifying coins), passed by only 38 per cent of six-year-olds. Successes at year VII were scored by some three-year-, four-year-, five-year-, and six-year-olds, at year VIII by some five-year- and six-year-olds, at year IX by two five-year- and two six-year-olds, and at year X by two six-year-olds. A superior ball and field plan was offered by one five-year-old (I.Q. 147) who had failed the previous year and now presented a plan he said he had "invented."

Results of First Examination.—The results of the first examinations may be seen from Table IV. The chronological ages of the 105 children at the first examination ranged from twenty-four months to seventy-two months with an average of forty-seven months. The mental ages (score on the test) ranged from twenty-six months to 102 months with an average of fifty-four and one-tenth months. The intelligence quotients (I.Q., mental age divided by chronological age) ranged from 79 to 156 with an average of 115.3. As an I.Q. of 90 to 110 is commonly interpreted as meaning average ability, 110 to 120 as superior ability, 120 to 140 as very superior, and 140+ as very rare ability, it will be seen that the children of this study were on the whole of superior ability. The fifty-seven girls have an average I.Q. of 116.6. The forty-eight boys have an average I.Q. of 113.1. The average I.Q. was 117.9 at two years, 111.9 at three years, 114.3 at four years, 119.8 at five years, and 116.1 at six years.

Discussion.—It will be noted that the average I.Q. of the five-year-old children is slightly higher than that of the other age groups, which often causes a disproportionate rise in the averages at that age for many tests reported in this study. The two-year-old children were also somewhat superior, which is probably due to the fact that children of this age are less often sent to a play group unless they

TABLE IV. — RESULTS BY AGES FROM PSYCHOLOGICAL EXPERIMENTS ON 105 CHILDREN

AGE		2 YEARS			3 YEARS			4 YEARS			5 YEARS			6 YEARS		
TEST		CHILDREN	RESULTS		CHILDREN	RESULTS		CHILDREN	RESULTS		CHILDREN	RESULTS		CHILDREN	RESULTS	
			Average	Range		Average	Range		Average	Range		Average	Range		Average	Range
Stanford-Binet	Chronological age, months	9	26.4	24–29	40	36.2	31–42	20	48.0	42–54	28	61.3	55–66	8	67.6	66–72
	Mental age, months . .	9	31.1	26–36	40	40.6	26–64	20	54.8	42–68	28	73.5	48–88	8	78.5	56–102
	I. Q.	9	117.9	96–144	40	111.9	84–156	20	114.3	79–141	28	119.8	86–154	8	116.1	85–155
Detroit Kindergarten	Score . . .	6	3.7	0–6	21	8.0	2–19	24	13.8	5–27	26	20.6	10–27	14	22.9	14–28
Card Sorting	Score . . .	4	−8.5	−13– −6	29	−0.1	−15–20	13	9.6	−12–24	9	22.6	14–33	6	24.0	19–31
Wallin Pegs Board A	Score . . .	5	4.0	0–6	28	6.0	6–6	13	6.0	6–6	10	6.0	6–6	5	6.0	6–6
	Time, seconds	3	103.0	60–170	28	47.9	21–122	13	31.2	18–53	10	30.6	22–51	5	23.8	18–30
Board B	Score . . .	5	0.2	0–1	28	2.3	0–6	13	5.5	0–6	10	5.8	4–6	5	6.0	6–6
	Time, seconds	0			7	33.0	27–44	11	32.1	18–63	9	26.6	17–45	5	25.2	21–36
Board C	Score . . .	5	2.4	0–3	28	3.9	0–6	13	5.5	3–6	10	5.8	4–6	5	5.8	5–6
	Time, seconds	0			7	36.3	23–56	10	30.5	17–60	9	23.7	16–34	4	24.3	21–29
Board D	Score . . .	4	1.4	0–3	28	3.8	2–6	13	5.5	2–6	10	6.0	6–6	5	5.8	5–6
	Time, seconds	0			8	69.6	48–166	10	69.6	25–267	10	37.5	22–60	4	32.8	28–37
Goddard Form Board	Failures . .	1			2			0			0			0		
	Time, seconds	5	257.0	494–97	28	76.0	338–34	24	38.1	70–28	28	30.4	47–22	8	26.1	36–18
	Errors . . .	5	21.6	35–10	28	5.5	32–0	24	1.5	9–0	28	0.9	4–0	8	1.3	5–0
Mare and Foal	Failures . .	3			6			3			0			0		
	Time, seconds	0			12	311.0	452–135	17	146.0	588–51	33	96.0	281–29	17	75.0	240–34
	Errors . . .	0			12	13.8	28–8	17	7.7	27–0	33	5.4	16–0	17	3.4	14–0
Montessori Cylinders Board A	Failures . .	3			5			0			0			1		
	Time, seconds	0			11	90.3	180–53	18	80.2	160–39	26	50.6	103–31	20	41.5	56–26

TABLE IV. — RESULTS BY AGES FROM PSYCHOLOGICAL EXPERIMENTS ON 105 CHILDREN —*Continued*

AGE		2 YEARS			3 YEARS			4 YEARS			5 YEARS			6 YEARS		
TEST		CHILDREN	RESULTS		CHILDREN	RESULTS		CHILDREN	RESULTS		CHILDREN	RESULTS		CHILDREN	RESULTS	
			Average	Range		Average	Range		Average	Range		Average	Range		Average	Range
Montessori Cylinders																
Board B	Failures . .	3			6			0			0			0		
	Time, seconds	0			10	83.8	148– 39	18	55.4	116– 18	26	42.1	58– 26	21	40.1	85– 26
Board C	Failures . .	3			15			11			6			3		
	Time, seconds	0			1	105.0		7	93.6	170– 56	20	70.3	167– 28	18	50.1	82– 27
Montessori Tower	Failures . .	3			13			12			9			4		
	Time, seconds	0			2	110.0	167– 53	6	42.4	75– 26	19	51.2	139.2–23.9	16	36.3	57-24.4
Form Cancellation	Score . . .	3	3.3	0– 5	16	7.8	0– 18	19	15.2	0– 20	28	16.1	0– 35	20	24.2	13– 39
Porteus Maze																
Cross	Score . . .	2	−14.0	−36– 8	18	24.3	−46– 56	18	50.7	6– 60	3	60.0	60– 60	11	59.1	50– 60
Diamond	Score . . .	2	8.0	−12– 28	18	28.4	−2– 42	18	40.9	30– 44	3	42.0	38– 44	11	44.0	44– 44
Star	Score . . .	2	−1.0	− 8– 6	18	12.8	−24– 34	18	28.8	6– 36	3	35.3	34– 36	11	35.1	32– 36
Three Hole	Score . . .	7	15.6	11– 19	34	20.1	10– 37	21	27.6	15– 38	20	35.0	26– 50	14	38.4	26– 47
Perforation	Score . . .	3	21.7	13– 30	24	18.7	9– 32	16	24.0	15- 37	10	32.0	20– 36	6	27.7	19– 34
Walking Board	Score . . .	0			19	2.3	0– 5	17	4.2	3– 5	4	4.8	4– 5	9	4.8	4– 5
Montessori Frames																
Frame A	Score . . .	0			16	2.1	0– 6	16	3.8	0– 6	8	5.8	4– 6	10	5.9	5– 6
Frame B	Score . . .	0			16	3.9	0– 15	16	8.1	0– 16	8	9.9	5– 16	10	14.7	5– 16
Frame C	Score . . .	0			16	4.9	0– 22	16	6.6	0– 22	8	12.9	1– 22	10	17.8	2– 22
Frame D	Score . . .	0			10	1.8	0– 11	16	2.9	0– 14	8	3.8	0– 18	11	10.5	0– 18
Frame E	Score . . .	0			10	4.6	0– 9	16	7.6	3– 9	8	8.6	6– 9	11	9.0	9– 9
Frame F	Score . . .	0			10	4.3	0– 7	16	6.4	4– 7	8	7.0	7– 7	11	7.0	7– 7
Frame G	Score . . .	0			10	0.0	0– 0	16	1.2	0– 6	8	1.1	0– 6	11	2.9	1– 6
Tracing Path	Score . . .	0			18	53.5	26– 80	12	72.2	38– 97	12	79.8	54– 96	8	86.3	73– 96

are of rather accelerated development. At all the age levels there are both average and superior children. It is probable that these children are fairly comparable with other groups of American-born children of good parentage.

Results of Repeated Examinations.—Fifty-nine children had two or more examinations. Two children show no change in I.Q. from the first to the second examination; thirteen show a negative, and forty-four a positive change. It would be without significance to consider the actual raw amount of these changes in I.Q., since a change of a few points at one I.Q. level may mean more than an equal change at another level. On the surface, the higher I.Q.'s appear to vary more either up or down than the average I.Q.'s.

In order to investigate the relation between the amount of change in I.Q. and the size of the I.Q. itself, each child's variation in I.Q. between the first and second examination was expressed without regard to the direction of change as a percentage of the first I.Q. About one-third of the children showed a change of less than 5 per cent in the second I.Q., fifteen a change of less than 10 per cent, twelve a change of less than 15 per cent, and ten a change of 15 per cent or more. The Pearson coefficient of correlation between the percentage of variation and the first I.Q. for these fifty-nine children is —.19 ±.08, showing that the tendency to vary was relatively independent of the I.Q. when the variation was expressed as a percentage of the original I.Q.

About two thirds, forty-four, of the children were given the second examination from three to five months after the first. The others were given it at longer intervals up to twenty months. The Pearson correlation between percentage change in I.Q. and intervals is +.22 ±.08, showing that there was a slight tendency for the I.Q.'s obtained after a longer interval to vary more.

The Pearson correlation between chronological age and percentage of change is +.48 ±.07, which shows a tendency for the older children to vary a little more than the younger.

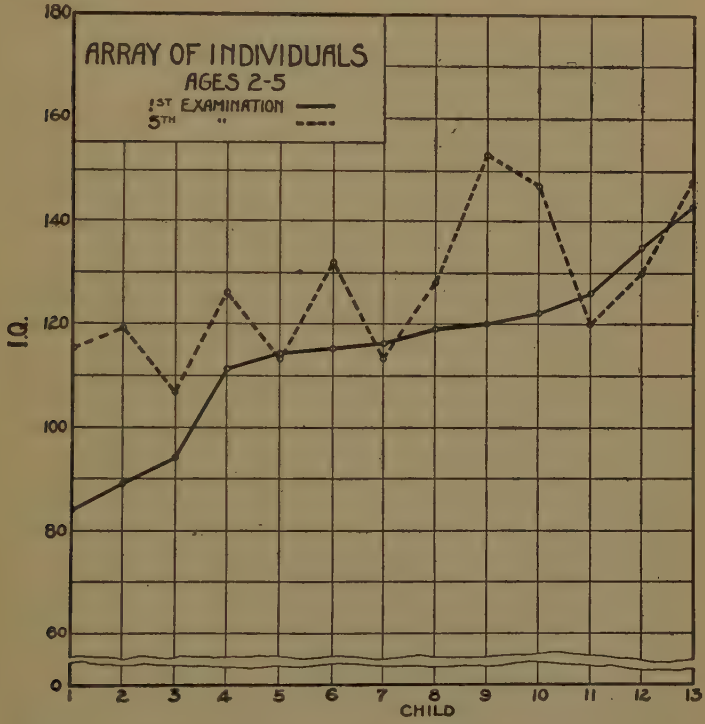


FIG. 15. THE SOLID LINE SHOWS THE RECORDS MADE ON THE FIRST STANFORD-BINET EXAMINATIONS; THE DOTTED LINE, THE RECORDS MADE BY THE SAME CHILDREN RESPECTIVELY ON THE FIFTH STANFORD-BINET EXAMINATIONS. THE MAJORITY SHOW A HIGHER SCORE (INTELLIGENCE QUOTIENT) ON THE FIFTH.

A number of children had three or four examinations. It will be sufficient to consider the thirteen children who had five consecutive examinations. Figure 15 shows these children in order of increasing I.Q. at the first examination and their position at the fifth examination. Four of the thirteen show a decrease in I.Q. from the first to the fifth examination of 1 to 6 points. Nine show an increase of 5 to 33 points. The average percentage of change in I.Q. for these thirteen children was 11.8 from the first to the second examination, 5.9 from the second to the third, 7.4 from the third to the fourth, and 9.9 from the fourth to the fifth. This would seem to indicate a somewhat greater change between the first and second examination than between any of the others. That this is not a constant tendency is proved by the fact that for the thirty-one children who had three examinations, the average percentage of change is 7.8 between the first and second examination and 7.2 between the second and third. So far we have not found an explanation of this discrepancy.

Discussion.—The later I.Q.'s are in general higher than the first ones, reflecting habituation to experimental conditions, practice, increased facility in the use of language, and mental stimulation resulting from the laboratory activities. In some cases the increase in mental age is so great as to give the impression that the child has actually increased in intelligence. A fairer interpretation would be that the first examination did not actually represent the child's intelligence or that the favorable environment had developed the potential mental ability of the young child. This actual demonstrable increase in mental status is an argument for giving the young child such opportunity for mental growth.

Detroit Kindergarten Intelligence Test

While the Stanford-Binet scale contains a number of tests depending more on performance than on the ability to use oral language, the Detroit kindergarten test [3] is composed entirely of problems to which the child responds by pointing to the required object.

Each of the eight tests consists of three or four minor tests. For example, Test 1, line 1, consists of pictures of three objects, a moon, a cup, and a sled; for the first the child is told, "Show me the thing that is up in the sky." The other two lines are similar. Test 2 shows a sample line with pictures of a hen, a rooster, and a duck, and four test lines in each of which there is a fourth bird that does not appear in the sample line. The child is told, "Show me the one that is not up there [in the sample line]." In Test 3, line 1, there are two halves of a pair of eyeglasses and one handle of a pair of scissors which looks quite like the half of the glasses. The child is told, "Two of these things belong together. Show me the one thing that does not belong with them." In Test 4, the sample pictures, a velocipede and a "kiddie kar" are to be compared with a dog, a child's wagon, and an apple, in accordance with the instructions, "Show me the one here that is nearest like these two [samples]." The other tests require comparison and judgment in order to perceive similarities in use or appearance or to detect absurdities. The scoring for the standardized test provides for a maximum of 30 points, without a time limit.

Observational Notes.—Most of the children grasped the idea of the test immediately and enjoyed it. A very immature child sometimes pointed to all the pictures and named the objects. As the tests became more difficult even the older children showed a tendency to random pointing, or to pointing to the left-hand or the right-hand picture all the way down the page instead of choosing in accordance with the directions. When such perseveration resulted in accidental success, credit was withheld for the test, although the authors of the test say nothing about doing so. With many of the children it was possible to tell by the child's general manner whether real comparison and judgment were taking place.

Results.—As may be seen from Table IV, the age averages or scores were 3.7 at two years, 8.0 at three years, 13.8 at four years, 20.6 at five years, and 22.9 at six years.

For comparison with the performance of these young children the Detroit program is given:

While no definite program of actual procedure has been determined for Detroit, it may be tentatively announced that pupils making a score of about 12 points or less will be placed in a slow-moving section and will, if necessary, remain longer than the traditional period in the Kindergarten. Those making a score of about 23 points or higher will, if feasible, be advanced to the first grade more quickly than the traditional time would permit. The remaining central group will probably proceed at a rate which has been considered normal.

Discussion.—The Detroit kindergarten test, while it has, like the Stanford-Binet, the advantage of furnishing an individual examination with plenty of time for the child to react, tests somewhat different functions from those in the Stanford-Binet. The abilities that go to make up fluency in verbal reactions are of course untested. The larger part of the Detroit tests require little previous instruction, but present a new situation in the face of which the child must make independent judgments. It is evident that the test is applicable as one approach to general intelligence, even below the conventional age of kindergarten entrance.

Learning

Although much of a young child's life is taken up with various forms of learning, psychological literature contains few reports of experiments on the effects of practice with young children. At the beginning of this study it was a question whether or not it would be possible to motivate a test sufficiently to obtain a long series of observations. The material, too, had to be of such a nature that it would permit of continuous learning.

Card Sorting

With the purpose of studying the practice curves of young children we devised the card sorting experiment (Fig. 16).

The material consists of fifty cards, 5 by 7 cm., cut from fairly stiff cardboard, with outline designs of ten geometrical figures (five cards of each) and a shallow pasteboard tray divided into ten small compartments.

Into each compartment of the tray is placed a sample card (Fig. 17). The pack of cards is well shuffled and a convenient number given to the child, with these directions: "You see all of these cards. We want to put these cards in these boxes, each card in its own box. See this card [the circle]; there's one like it. See this card [the square]; there's one like it. Now you put all of the other cards into the boxes where they belong. Pick up just one card at a time." A stop watch is started when the child begins the test. When the child places a wrong card in a box, the card is removed [in order that the sample may not be covered], and the error recorded. At the end of two minutes the child is asked to stop. Each day the same experimental pro-

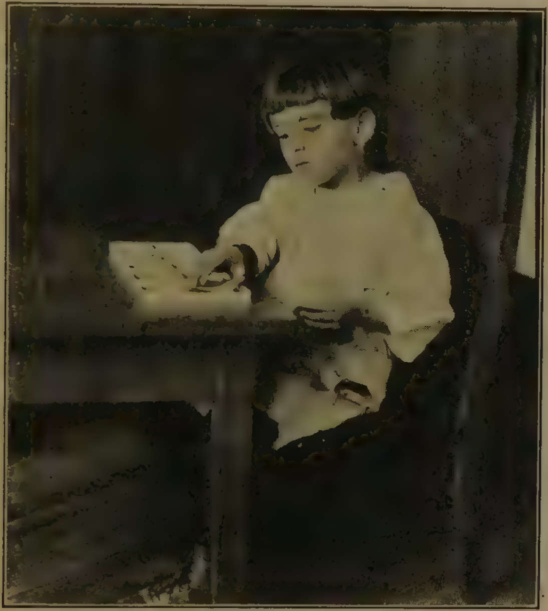


FIG. 16. SORTING CARDS IN ORDER TO LEARN TO DISCRIMINATE FORM.

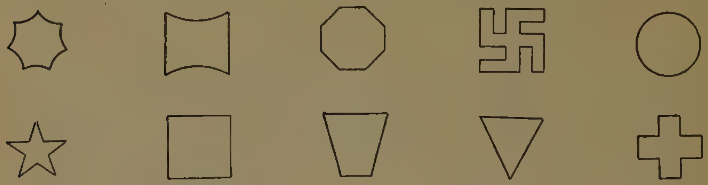


FIG. 17. THE SAMPLE CARDS ARRANGED FOR THE CARD-SORTING EXPERIMENT.

cedure is used until gradually it is no longer necessary for the experimenter to show where the first two cards belong, as the child places them immediately. The score is always the number of cards placed independently by the child.

Observational Notes.—The children were encouraged from time to time to keep at the task, and when they looked up for recognition of the successful placing of a difficult card, they were encouraged with a nod. After several trials they began to ask: "Why do we play this game every day?" They were told, "We want to see how many more you can put in their right places today than you did yesterday." They were encouraged to look into the boxes after each trial to see how many they had done. Some children wanted to see the cards counted. The older children were more interested in their improvement. They understood better what the score means and enjoyed counting the cards with the experimenter after the test.

At the first trials the younger children had very little idea of what is required, frequently distributing the cards wildly or putting all in one box, usually the one nearest them. Some noticed that the experimenter took the wrong cards out of the box and asked why. They were told that those did not belong in that box. Some had so little idea of what is wanted that they put cards in and took them right out for the convenience of the experimenter. Many children seemed to understand the directions and made several correct placings, but suddenly lost the thread of the task and began placing cards wildly, or put cards in upside down without looking at them.

The majority of the children in this group worked at the card sorting once a day, five days a week, until the twenty trials were completed. Some of the children were absent for considerable periods, however, and almost all had an occasional day's absence. The larger interruptions, of course, had their effect on the practice curve, but this disturbance was not so serious as might have been expected. For about one third of the children there was an interval of approximately one month between the tenth and eleventh trial which resulted in a decrease of score in some cases. This decrease was in general no greater than when only an occasional day was lost.

Results.—Table V shows the data for the twenty trials for fifty-six children. The score for the test is in terms of the number of cards placed correctly and incorrectly. By simple subtraction a composite score is obtained, which is positive in case the correct placings predominate and negative if the child makes more errors than correct placings. As shown in Table IV, the age averages (based on the average composite score for the number of cards correctly placed in twenty trials by each child) increased from –8.5 at two years to –.1 at three years, 9.6 at four years, 22.6 at five years, and 24.0 at six years. It will be observed that the change from negative to positive scores occurs at four years.

It seemed to the examiners that the children who began with a good score did not always end with so good a record as might have been expected. In order to furnish a quantitative statement of this tendency we computed for the fifty-six children the Pearson correlation between the first and the twentieth score and found it to be +.71 ±.05. This shows that while there is a high degree of correspon-

TABLE V. — COMPOSITE SCORES IN CARD SORTING OF 56 CHILDREN ON 20 TRIALS

	MEDIAN AGE, MONTHS	TRIALS																			
		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII	XIX	XX
Child 1	29	− 8	− 3	− 5	− 7	− 1	−13	−12	−18	−12	− 6	−14	− 3	− 8	−13	−10	− 5	− 5	−12	− 8	−15
Child 2	29	− 7	− 4	− 6	−10	− 5	− 5	− 8	4		− 2	4	10	17	11	13	20	16	20	12	17
Child 3	29	−13	−10	− 9	−14	−12	−11	− 5	− 5	− 8	− 6	− 8	− 9	−13	− 8	−10	− 5	−10	−14	− 6	− 9
Child 4	32	− 9	−13	−11	− 7	− 6	2	− 3	− 6	− 4	− 5	− 5	− 6	−11	− 2	− 4	− 9	− 5	− 1	7	3
Child 5	32	− 3	− 7	− 3	− 8	− 9	− 6	− 9	− 8	− 4	− 6	− 8	− 4	−10	− 9	− 4	− 7	−12	− 8	−12	−10
Child 6	33	−15	−19	−16	−18	−24	−36	−27	−15	− 8	− 1	− 2	2	3	6	17	6	− 1	7	4	12
Child 7	33	− 7	− 8	−11	− 6	0	3	2	8	4	6	3	3	2	7	5	13	8	13	5	14
Child 8	33	− 9	− 8	− 7	−10	− 4	−10	−15	− 8	− 5	− 8	− 9	− 8	−12	−10	−12	−14	−14	−17	−11	−11
Child 9	33	− 6	1	−11	− 7	− 2	− 1	1	3	4	− 1	8	9	9	− 5	11	8	5	3	13	11
Child 10	35	−11	− 8	−10	−11	−13	−16	−18	−16	− 3	− 5	− 5	− 6	− 2	− 3	− 2	0	4	−11	4	8
Child 11	35	− 6	− 5	− 4	1	1	3	5	4	− 1	8	8	5	9	7	6	3	10	4	4	5
Child 12	36	− 3	8	9	9	9	10	10	16	10	13	15	14	10	17	12	12	12	12	7	14
Child 13	36	0	1	−10	3	0	7	6	3	2	9	7	10	6	15	10	14	5	17	12	14
Child 14	37	20	21	16	21	25	28	24	24	27	33	26	22	28	22	26	26	26	27	19	11
Child 15	37	13	16	13	23	20	23	28	16	23	22	22	17	23	15	17	16	25	22	23	21
Child 16	38	0	7	8		31	29	27	21	23	24	30	26	38	32	40	35	26	41	25	31
Child 17	38	−10	−11	− 8	−18	− 3	2	− 2	7	4	− 1	− 5	1	1	−17	− 3	− 7	− 9	−26	−16	−34
Child 18	38	14	18	19	11	19	16	17	19	16	13	18	11	13	13	13	12	11	11	10	14
Child 19	39	4	8	2	11	12	12	12	15	14	16	12	25	18	15	21	17	28	17	20	19
Child 20	39	− 9	−10	−19	−14	−12	−16	−16	−14	−17	− 8	−15	− 3	5	11	13	14	12	21	15	20
Child 21	39	9	14	14	17	19	12	15	14	15	20	15	19	20	21	17	18	17	11	9	7
Child 22	40	− 6	− 2	− 5	3	14	24	32	32	31	35	28	35	28	35	33	29	36	31	29	28
Child 23	41	− 8	− 2	− 1	3	18	14	17	18	13	16	22	16	23	20	21	17	17	21	18	21
Child 24	42	14	7	11	12	17	17	20	12	15	21	23	12	14	12	17	18	19	22	13	13
Child 25	42	3	12	17	22	20	15	21	18	24	17	24	28	27	30	34	34	36	36	33	38
Child 26	42	10	10	14	19	21	21	16	17	18	25	18	15	18	32	18	17	23	15	24	24
Child 27	42	1	6	19	21	24	21	19	24	22	23	22	19	21	19	24	23	25	17	21	24
Child 28	43	4	11	17	10	14	14	15	18	20	13	14	15	18	18	19	21	22	17	22	12

TABLE V. — COMPOSITE SCORES IN CARD SORTING OF 56 CHILDREN ON 20 TRIALS — *Continued*

	MEDIAN AGE, MONTHS	TRIALS																			
		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII	XIX	XX
Child 29	43	13	12	19	14	23	27	14	26	24	20	31	31	32	30	32	39	37	39	45	43
Child 30	44	− 9	− 2	− 5	− 9	− 3	6	7	3	18	25	25	25	34	26	30	29	30	31	24	17
Child 31	45	10	13	17	20	15	16	18	18	16	23	22	21	22	21	19	20	16	17	18	17
Child 32	46	12	11	11	18	11	15	15	23	28	23	19	16	21	18	16	15	14	14	26	26
Child 33	46	13	14	14	12	12	14	25	23	24	28	25	28	23	27	24	22	19	22	27	28
Child 34	51	13	21	19	22	11	20	20	20	21	14	17	21	22	19	16	24	23	16	24	16
Child 35	51	13	14	23	20	23	26	22	28	21	16	25	8	23	22	12	20	18	21	26	21
Child 36	51	19	29	33	29	33	28	30	22	20	23	27	26	23	24	26	25	21	27	30	24
Child 37	51	17	10	16	27	21	21	17	21	24	25	18	23	29	20	19	22	20	15	15	23
Child 38	51	20	36	31	37	46	47	52	54	50	51	57	56	41	46	44	54	30	45	43	36
Child 39	51	−12	1	− 1	2	5	7	7	9	16	25	24	23	26	23	18	31	23	34	26	24
Child 40	52	−12	7	13	15	18	21	18	21	23	19	27	26	15	25	23	28	32	29	17	27
Child 41	55	24	27	24	33	35	34	34	35	45	41	41	42	39	39	47	38	40	50	46	40
Child 42	62	19	28	32	30	33	35	33	38	34	32	39	27	39	32	45	36	32	42	43	36
Child 43	62	14	23	22	32	24	25	21	19	18	23	25	31	26	28	34	25	23	35	23	36
Child 44	63	33	41	33	39	44	60	53	58	57	49	50	33	31	51	56	50	37	34	35	29
Child 45	64	25	32	34	41	56	62	47	50	48	48	48	46	56	51	57	54	47	43	46	58
Child 46	64	16	21	27	24	18	24	29	32	33	23	32	34	27	32	28	31	24	24	23	23
Child 47	64	28	33	36	28	30	37	35	31	32	33	47	36	39	37	32	33	39	35	25	37
Child 48	65	31	46	47	55	56	59	63	60	61	56	57	44	53	62	63	64	66	72	68	68
Child 49	65	15	17	21	24	23	18	28	29	32	25	18	22	22	25	21	29	27	19	23	21
Child 50	65	22	30	26	36	45	36	42	39	35	34	42	37	39	44	42	55	49	34	45	46
Child 51	67	19	28	27	25	27	31	35	44	25	30	32	24	28	37	40	31	42	43	28	33
Child 52	68	22	22	31	35	47	52	43	57	49	53	52	59	51	53	63	51	47	44	58	39
Child 53	68	19	28	30	28	28	34	37	29	38	47	49	51	41	56	48	58	60	64	53	34
Child 54	69	31	41	48	46	45	47	56	54	59	55	58	47	52	58	46	43	60	52	62	57
Child 55	69	31	38	48	47	48	53	58	48	54	62	58	68	68	64	69	60	62	57	59	71
Child 56	74	22	37	33	41	43	39	31	43	41	41	43	45	44	46	38	41	37	43	42	47

dence between the rank on the first and on the last trial it is far from perfect. The relation between a child's initial score and its improvement from the first to the twentieth trial was shown by the Pearson correlation method to be —.02 ±.09, which indicates that a child with a good initial score does not make any more improvement than one with a poor standing at the beginning. This may possibly be due to the fact that the child who places many cards during the time limit is working near its physiological limit and can not do this much faster, even if ease of recognition increases, until mere physical growth brings an increase in the speed of movement and in general motor control.

Type Cases.—Figure 18 represents selected practice curves. The elevation of the curve above the zero line (where just as many cards are wrong as right) shows the improvement in the function. Inspection of the curves shows great individual differences in the performance of the children.

Child A, Age 4 Years, 5 Months

A, a girl, was an excellent worker, quick and systematic. At 4 years, 5 months she showed considerable maturity and her I.Q. on the first examination, 126, probably represents her real ability. She made a good score, with only one error at the first trial, and generally accelerated her speed during the course of a trial. She held the pack in her left hand and dealt the cards out with her right, usually working so fast that she did not trouble to turn the cards around when she accidentally placed the triangle point down, for example. Her average composite score was + 37.7.

Child B, Age 3 Years, 5 Months

B, aged 3 years, 5 months, a girl with an I.Q. of 115, always worked rather deliberately. Her general ability was good and she showed recognition of the problem from the first. Her curve is one of steady improvement. She experienced some manual difficulty in picking up just one card at a time and getting the cards

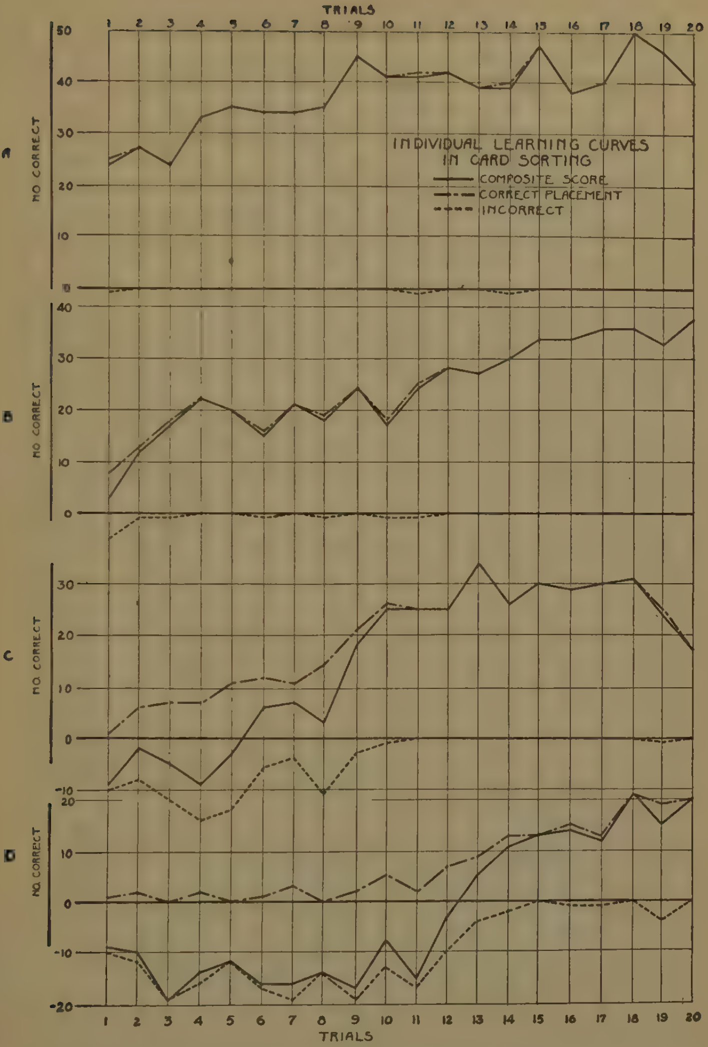


FIG. 18. THESE CURVES SHOW THE IMPROVEMENT OF FOUR CHILDREN WITH PRACTICE IN SORTING CARDS.

into the boxes, but went about the task systematically, taking up a card, carefully inspecting it, and placing it. Her average composite score was + 24.1.

CHILD C, AGE 3 YEARS, 6 MONTHS

C, a girl of good general ability (I.Q. 119), made a poor start. She found the discrimination of the form differences very hard and seemed puzzled and discouraged. After the eighth trial she seemed to understand a little better and made a good deal of improvement, working steadily and consistently during each trial. Toward the end of the series she was absent a good deal and lost interest in the "game," making a poor score during the last two trials. Her average composite score was + 15.1.

CHILD D, AGE 3 YEARS, 1 MONTH

D, a girl with an I.Q. of 111, was slow and awkward in her movements. Her early trials showed an entire absence of understanding of the purpose of the test, her object being apparently just to get as many cards as possible placed in boxes, any boxes. She did not even look at the cards, and placed many face-side down. By the seventh trial there seems to have been some understanding of what the experimenter was saying in illustrating the placing of cards. At the twelfth trial she seemed to be really discriminating between the cards and was placing some by design. She could not keep this up, however, but alternated between discrimination and haphazard placing. During later trials she worked carefully with good attention, but her early lack of success reduced the average composite score to + 2.1.

Discussion.—Improvement in the performance meant primarily discrimination of the ten designs. It was to have been expected that a child would gradually learn one form after another, persistently confusing certain forms. An inspection of the errors made by the children does not, however, reveal any such persistent confusion. It is possible that the designs are not all of the same difficulty. There was possibly a somewhat greater resemblance between the two octagons than any other two figures, but these also were soon distinguished even by children who hesitated between them at first. The children were discovered to be developing an increasing memory of the positions of the various designs. Individual children had their favorites which they quickly recognized and placed. Some of the children had names for the designs; one little boy called the swastika a ''jigger'' and the Maltese cross a ''figger.'' The association value of these words doubtless aided in the correct placing of the designs.

This type of material could be supplemented by the use of color cards, forms to be canceled, simple substitution tests, or purely motor performances, such as inserting a large number of round pegs into holes. The analysis of additional practice curves on a large number of young children is greatly needed for the study of individual differences in learning, and the relation of these differences to such factors as age, sex, and general ability.

CHAPTER IV

MENTAL DEVELOPMENT: EXPERIMENTS IN MOTOR CONTROL AND COÖRDINATION

EVEN casual observation of the play activities of a little child reveals an astonishing lack of motor control, as shown in such performances as its painful attempts to fit a nail into a ready-made hole or its awkward handling of a spoon in filling a jar with sand. This manual ineptitude is often complicated by undeveloped perception of the form and relative size of objects, as seen in the baby's repeated attempts to press a large square box into a small round one. In our study of the development of motor ability, tests modeled on such activities of children have proved very successful, not only because they require no facility in language, but also because they appeal to the instinctive drives at the basis of play itself.

Motor Control and Form Perception

The materials used for this study of motor control and form perception are the Wallin pegs, the Goddard form board, and mare and foal picture board, the Montessori cylinders and tower, and a form cancellation test. The results are given in Table IV.

Wallin Pegs

The peg boards described by Wallin[144] (Fig. 19) offer one means of approaching the development of motor control and form perception. There are four boards, each containing six appropriately shaped holes into which round, square, or triangular pegs are to be inserted.

In this experiment all the pegs for all four boards are piled in a tray beyond the board, which is placed longitudinally before the child close to the edge of the table at which the child sits. The boards are placed before the child one at a time in the order A, B, C, D, with the marked end of the board always at the left hand so as to keep the order of holes the same in boards C and D. The examiner sits near and says, "Put these in their right holes." If the child can not find a peg to fit the hole or gives up trying, the examiner says, "Look in here [the tray] again. Try another; there is one to fit every hole." The examiner has a diagram of the holes in the four boards and records each move by drawing and numbering the symbols for the peg under the hole in which it is being tried. If one peg is tried in several holes, this is indicated by arrows. The time is recorded for successful completion of each board.

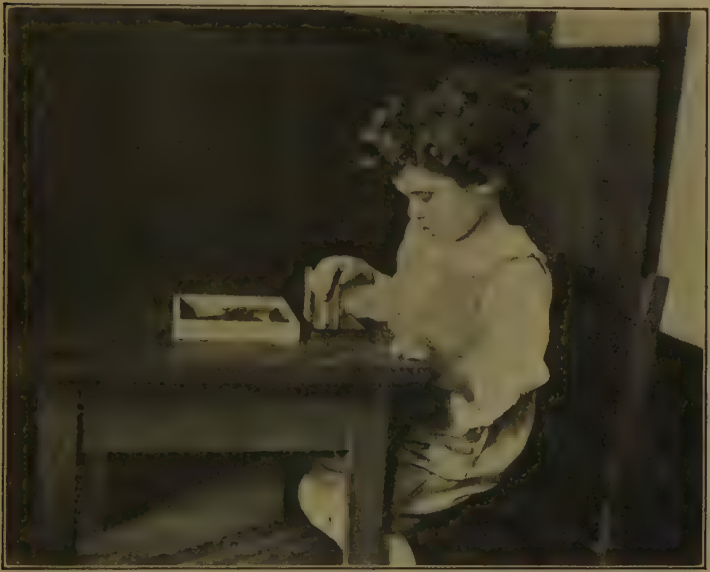


FIG. 19. EACH PEG HAS ITS PROPER HOLE IN THE WALLIN PEG BOARD.

The test is easily understood, and even a child of a year will make some attempt to fit the pegs into the holes. The children enjoyed the performance, although sometimes when a child became discouraged at not finding the right peg, it gave up and began to play a game of its own with the pegs.

Results by Scores.—We may consider first the results in terms of the actual number of holes filled.

Board A.—Almost all the children were able to place all the round pegs in the round holes of Board A. This is more a test of motor control than of form perception for a child of two years or less.

Board B.—Fitting square pegs into square holes was an all-or-none affair for most of the children. For about half of the children who did not immediately fill up all the square holes with round pegs it usually meant that they had really distinguished square and round and were able to place all the square pegs. It would be of great interest to know, when a child continues to use round pegs for square holes after the first mistake, whether this is due to inability to perceive differences in form or to the "momentum" of having made an apparently successful start with the round ones, which serves as an adequate stimulus for the next reaction. In some cases a child who had correctly placed a square peg took it out and replaced it with a round one under the influence of this suggestion. In a few cases, a child apparently by accident placed a square peg correctly, but filled up the other holes with round pegs. The two-year-olds had practically no success with this board. The three-year-olds averaged about two correct placements. By four years there was almost complete success.

Board C.—Filling in round and square holes usually gave a score of 3 or 6, depending on whether or not the child really discriminated round and square or merely filled all the holes with round pegs, there being three chances to gain a score as a result of the carrying over of the habit of using round pegs. The average score of 2.4 at two years increased to 3.9 at three years. By four years the average score was almost perfect.

Board D.—The round, square, and triangular holes present a new form and consequently represent a larger step forward in difficulty than do other members of the series. With this board there are two chances to gain credit by the persistent use of round pegs. The motor control required in fitting the square and triangular pegs into the proper holes is in itself a difficulty in addition to that of selecting the correct pegs. The average score at two years is 1.4 and at three years 3.8. Beyond four years there is not much increase in the number of pegs correctly placed. It is evident that all the boards are better tests for two- and three-year-old children than for older children.

Results by Time.—The time for successful completion of each board decreased by ages as follows:

TIME REQUIRED FOR COMPLETION OF BOARDS BY AGES

Board	Time for Successful Completion				
	Children 2 Years, seconds	Children 3 Years, seconds	Children 4 Years, seconds	Children 5 Years, seconds	Children 6 Years, seconds
A	103	47.9	31.2	30.6	23.8
B		33.0	32.1	26.6	25.2
C		36.3	30.5	23.7	24.3
D		69.6	69.6	37.5	32.8

Board D is the hardest, as judged by time. Board A comes next, possibly because of the adjustment necessary at the beginning of the test. Boards B and C are of about equal difficulty, as judged by time.

Comparison of our results with those of Wallin can not be made because of his limited number of young children and the differences in the method of presenting the boards.

Results on Repeated Trials.—The time for successful performance on a second trial two weeks later was somewhat reduced for Boards A and D and the number of successes raised for Boards B, C, and D, as is shown by the tabulation:

Time Required for Completion of Boards in Two Trials

	Board A		Board B		Board C		Board D	
	Trial 1	Trial 2	Trial 1	Trial 2	Trial 1	Trial 2	Trial 1	Trial 2
Children Successful..	59	59	32	37	30	38	32	41
Average Time, seconds ...	41.9	32.8	29.6	28.1	28.9	20.2	54.9	47.2

A group of twenty-two children was given four trials on each board, at two weeks' intervals. Ten of the children were successful in placing the correct pegs in all four boards at all four trials. Two additional children passed Board B and one of these two passed Board C also. The average time for successful completion of the boards decreased with successive trials, although not consistently, as follows:

Average Time Required for Completion of Boards

Trial	Time for Test			
	Board A, seconds	Board B, seconds	Board C, seconds	Board D, seconds
1	36.4	35.1	34.9	50.8
2	29.7	29.4	29.9	43.0
3	28.1	29.8	28.2	40.7
4	26.9	30.8	28.2	45.0

The largest improvement came between the first and second trial; the expected improvement between the later trials did not occur, probably because of lack of interest.

In two instances, children who had successfully placed the pegs in Boards C and D at an earlier trial "got on the wrong track" and could not complete the board thereafter.

The tendency to continue placing round pegs in square holes was lessened by practice, but was not entirely eliminated in the fourth trial. With some children this tendency frequently carried over in a 3 to 3 ratio with the third board, but many of the same children were successful with the fourth board.

The children were particularly delighted when they succeeded in placing the triangles, which they regarded as "very hard." In some instances, the memory that the triangles were to come hindered speed with the third and fourth boards in later trials, or sometimes only with the third board, depending on whether the child rejected the triangles entirely or clung to the idea that they were still to be used. Many children filled the triangles first or hunted for the triangular pegs, which were often difficult to distinguish in the tray. As the trials went on a growing sense of serial order was evidenced; this sometimes helped and sometimes hindered speed. Picking up many pegs and holding them in the hand while placing some other peg was probably a hindrance to speed, as was also the practice of some very methodical children who selected and laid the appropriate peg in front of each hole before placing the pegs.

Discussion.—For a very young child, even for an infant fifteen months, the Wallin Board A, with round pegs, furnishes a good test of manual dexterity. The fact that the child understands the task and succeeds in inserting a certain number of pegs is a good index of its development. With Board B the ability to note the appearance of a new form, the square, and to resist the habitual impulse to continue using round pegs makes a further step in mental development. Board C has less diagnostic value. Board D, with its third form, the triangle, offers an even more difficult problem. For older children the time taken in actual form discrimination and in manipulation is valuable for scoring purposes. The peg boards are of more value, however, for the qualitative analysis of the reactions of younger children.

Goddard Form Board

Although the original form board was devised by Seguin for training mentally deficient children in form perception, later workers have found it useful for studying the development of this capacity. Various experimenters have used various forms, but the problem confronting the child is always the same, a board in which are cut a number of geometrically shaped recesses and the corresponding blocks to be fitted into the holes.

The form board used in this investigation was the Goddard board. It is very similar to the Sylvester board and was accordingly given by the method standardized by Sylvester[132] and used also by Pintner and Paterson.[108]

> The children stand before a low table on which the board is placed, with the ten blocks in three piles at the right of the board, no block in the same row with its proper space, the star on the bottom layer and the lozenge and diamond on different piles. The experimenter says, "You put the blocks in the holes where they belong just as quickly as you can without making any mistakes." These instructions are repeated before each of three trials. The time and errors are noted. The experimenter also notes the reactions of the child. The best time on the three trials is used for the child's record.

Observational Notes.—The children easily grasped the idea of putting the blocks in their right places. Some hunted a place to put a block they had picked up, and others looked first at the holes in the board and then selected a block to fit a particular hole. The older children worked more systematically and less by trial and error than the younger ones. They made fewer original misplacements of blocks and were more persistent in finding a place for a block when once they had picked it up, instead of getting discouraged or being satisfied with a partial placement. The more intelligent ones also were able to recall the position and form of a space previously noted, when they came across the corresponding block in the pile, or to remember the correct block when confronted with an empty space. Many of the younger children persistently tried to force a block into the wrong hole.

The children had individual difficulties. For some the diamond and lozenge were particularly confusing. Others had trouble with the star and cross, or with the triangle and diamond. Many children who had made mistakes of this kind on the first trial made them again on later trials. Almost all the young children experienced difficulty in getting the block into the hole, particularly the star which they were liable to twist. Even the picking up of the block presents difficulties because of the fine motor coördinations involved.

Results.—The average time decreased from 257 seconds at two years to 76 seconds at three years, 38.1 seconds at four years, and 30.4 seconds at five years to 26.1 seconds at six years. The errors also decreased very rapidly between two and four years. Pintner and Paterson quote no norms below five years, where the 50 percentile time is 37 seconds. Our five-year average, 30.4 seconds, is lower than this.

Discussion.—The test is an excellent one for young children; it resembles the block games enjoyed by many children at home and affords opportunity for producing a visible result. The norms could profitably be extended below the five-year level, where the clinical use of the test now stops.

Mare and Foal Form Board

The Healy mare and foal form board, in which seven irregular pieces cut out of a picture of a farm scene are to be fitted in again by the child, offers a situation that tests not only form perception, but also the ability to grasp the picture as a whole and to understand the relationship of the parts of the picture (Fig. 20). The test is given in the laboratories by the modified method of Pintner and Paterson,[108] as follows:

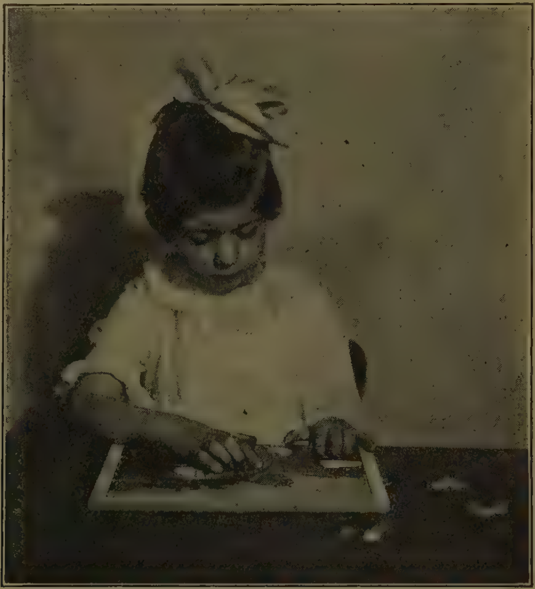


FIG. 20. THE JIG-SAW PUZZLE IS A GOOD MENTAL TEST.

> The board is placed in front of the child with the seven pieces at the top in the prescribed arrangement, and the child is told, "Put these pieces in the right places as quickly as you can without making any mistakes." The time is taken for the complete performance and the errors counted. The child is stopped if it has not finished after ten minutes.

Observational Notes.—The majority of the children thought the game easy. The younger children used a trial and error method. Others regarded it merely as a task in fitting forms. One boy of four and a half years who was asked how he knew that a certain piece belonged in a certain hole where he had correctly placed it said, pointing to a curve, "There's a little hill here." This same boy exclaimed with surprise, when all the pieces were correctly placed, "Why, I didn't know I was making a picture."

Although most of the children recognized parts of the picture, placing a horse's head or the sheep or the chicken intelligently, the apperception of the picture as a whole and some comment, such as, "It's in the country," did not come until the later ages.

Results.—A number of children at the lower ages failed to complete the picture. The average time decreased from 311 seconds at three years to 146 seconds at four years, 96 seconds at five years, and 75 seconds at six years. The errors decreased from 13.8 to 3.4 at these extremes. Pintner and Paterson report no norms below five years, where the 50 percentile is 107 seconds with 7 errors, again a somewhat poorer performance than our five-year average.

Discussion.—Our results seem to show that the test is applicable at much lower ages than hitherto it has been supposed to apply. The much longer times taken at the lower ages are probably due to manual difficulties, as very accurate movements are required to make the irregularly shaped pieces fit into their holes.

Montessori Cylinders

Discrimination of differences in the diameters and heights of cylindrical inserts and their corresponding holes was studied by means of the cylinders used by Montessori[90] for giving children experience with these variables (Fig. 21). For the sake of securing comparable results, the technic of Woolley and Cleveland[153] was adopted, although the directions seem too full and explicit to allow sufficient credit for the bright child who is able to adapt itself quickly to the requirements of the situation.

There are three sets of ten cylinders each, the first varying in diameter, the second in both diameter and height, and the third in height only. The purpose in each case is to determine the time required for a perfect performance. The cylinders of the first set are taken out one by one and placed beside the frame on a low bench or chair so that the child can look down into the holes. They are then returned one by one to their holes, and the following formula is used: "See how these cylinders come out of their holes. Each has a hole where it just exactly fits, the big ones in the big holes and the little ones in the little holes. Now I am going to take them out again and mix them all up and see if you can put them back into the holes where they just fit." The cylinders are then removed and placed again beside the frame, thoroughly mixed, and the child told, "Now, go ahead,"

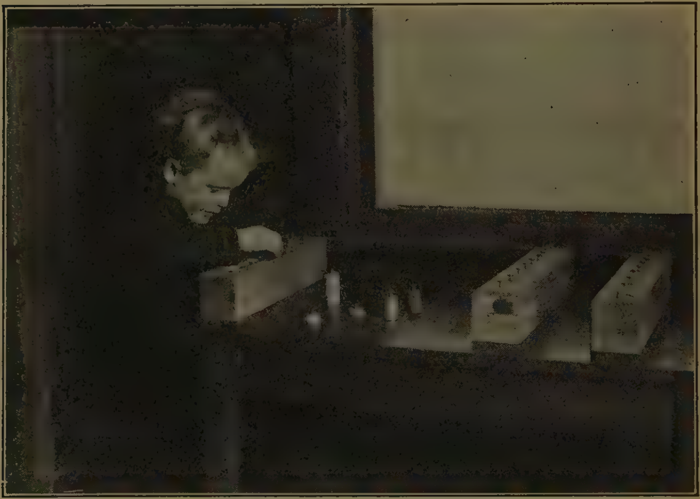


FIG. 21. THE SHORT AND THE LONG CYLINDERS MUST BE DISCRIMINATED.

and allowed to proceed as in the previous test. With the second and third sets the first illustrative replacing is omitted. The time required to fit the cylinders into the holes is recorded in seconds; a three-minute time limit is allowed, and only a perfect performance counted as success. The sets are lettered A, B, and C, and the cylinders numbered according to size from 1 to 10, and the order of placing recorded.

Observational Notes.—All the children were delighted with the test and readily grasped the idea of replacing the cylinders. For Board A, the directions are rather too long. The children could hardly wait while the examiner pulled out the cylinders, put them back, and pulled them out again. It would probably be better to allow the children themselves to take out the cylinders, although this would of course give them a better opportunity to learn where the cylinders fit. One sees in the less developed children the same awkwardness and the same errors that are shown with the Goddard board. Several children took out correctly placed cylinders in the hope of forcing into the hole another cylinder for which a place could not be found. Much trial and error experimentation went on. Board B is somewhat easier than Board A; but both boards were very easy for the older children. They made their judgments at once, and usually worked in a systematic manner from large to small.

Results.—The boards are seen to be unequal in difficulty, as shown by the number of children who completed the task and by the time for successful performance.

Board A.—No two-year-old child succeeded. The time required for successful placing of all ten cylinders was 90.3 seconds at three years, 80.2 seconds at four years, 50.6 seconds at five years, and 41.5 seconds at six years. These times may be compared with Woolley and Cleveland's 50 percentile times at three, four, and five years, which are 90, 64, and 47 seconds.

Board B.—The second cylinder board is easier than the first, as is shown by the general reduction of time, perhaps as a result of practice. No children of two years succeeded. The average time for three-year-olds was 83.8 seconds, for four-year-olds 55.4 seconds, for five-year-olds 42.1 seconds, and for the six-year-olds 40.1 seconds. Woolley and Cleveland's 50 percentile at three years is 76 seconds, at four years 60 seconds, and at five years 41 seconds.

Board C.—This board presents more difficulties than do either of the others, as is shown by the longer time taken to place all the cylinders. All the two-year-olds failed. The average was 105 seconds at three years, 93.6 seconds at four years, 70.3 seconds at five years, and 50.1 seconds at six years. Woolley and Cleveland's 50 percentile did not complete the board at three or four years, but completed it in 77 seconds by five years.

Discussion.—These Montessori cylinders, because of their ease of administration and great appeal to young children, should form one of our most valuable tests for the study of development in form perception and motor control. The attitude and general behavior of the child during the performance furnishes additional data of importance for individual studies.

Montessori Tower

Another test for the perception of differences in size, the Montessori tower (Fig. 22), was given by the method of Woolley and Cleveland.[153]

> The Montessori tower consists of ten blocks to be placed one on another in order of size, from a 10 cm. cube to a 1 cm. cube, the purpose being to determine the time required for a perfect performance. The tower, properly built up on the floor, is exhibited, and the following formula used: "Look at this pretty tower. Do you see how it is built with the biggest block at the

bottom and then the next biggest, and so on up to this little baby block on the top? Do you think if I knock the tower down, that you could build it again just the same way, with the big block on the bottom and the little block on the top?" Whatever the response, the tower is then knocked down, care being taken to have the blocks near together in easy reach, and thoroughly mixed. The child is then told, "Now, go ahead," and allowed to build the tower without assistance. If the blocks are incorrectly placed when the child has finished, it is asked, "Does that look right to you?" The question is asked after the time has been recorded. Success or failure and time in seconds are recorded. A three-minute time limit is allowed and only a perfect performance counted as success. The blocks are numbered in order of size, from 1 to 10, and the order in which they are placed is recorded.

FIG. 22. NOT EVERY TOWER IS BUILT ON CORRECT ARCHITECTURAL PRINCIPLES.

Observational Notes.—Several of the younger children could not get the idea of building a tower, but laid the blocks in rows or built several small towers. The smaller blocks seemed to be easier to place in their correct order than the larger ones. The children who failed to build the tower correctly did not know that they had failed, but always expressed complete satisfaction with their product. Many children who made mistakes corrected them at once. A number of children explained their methods, such as finding the ''biggest and then the next biggest'' or ''making steps.''

Results.—The perfect performance was beyond the ability of the two-year-olds. Those at three years who completed the tower took on the average 110 seconds, at four years 42.4 seconds, at five years 51.2 seconds, and at six years 36.3 seconds. These times may be compared with Woolley and Cleveland's 50 percentile results, which give 37 seconds at five years, but only incomplete performance at three and four years.

Discussion.—The Montessori tower test is an attractive and familiar occupation for young children and gives an immediate index of the development of a child's knowledge of size relationships. A method of scoring for partial success might prove useful for children under five years. A tower involving only five blocks for the examination of younger children is now being standardized by the Merrill Palmer School and by the Iowa Child Welfare Research Station staffs.

Form Cancellation Test

Ability to distinguish simple geometrical figures and motor control in the movements of marking with a pencil were studied by means of a simple form cancellation test.

The child is presented with a practice strip of paper consisting of the first three lines of the Woodworth and Wells [150] substitution blank. This contains outline figures of a star, circle, square, Maltese cross, and triangle in chance order. A demonstration card is also shown upon which is pasted one of the outline squares cut from a blank.

The experimenter says, "Now you take this pencil and put a mark through each picture like this," pointing to the demonstration square and indicating one after the other of the squares on the practice strip. The child is allowed to spend one half minute marking out such squares as it can find. The practice sheet is then removed, and the full-sized blank containing 100 figures, with the substitution key cut off thé top of the sheet, is presented, with a demonstration card on which is an outline circle. The experimenter says, "Now you make a mark through all the pictures that are like this," showing the demonstration circle but not the circles on the blank. The child is allowed to work at the blank one minute. The score is the number of circles correctly marked.

Observational Notes.—The test was quite difficult for the younger children. Some of the children were so much influenced by the practice that they continued to mark squares during the test itself or reverted to marking squares after doing a few circles. Others had great difficulty in handling a pencil and merely made jagged marks. These children probably did not understand the task, as others who showed equally poor motor control confined their scratching to the immediate neighborhood of the circles.

Results.—The average score increased from 3.3 circle cancellations at two years, through 7.8 at three years, 15.2 at four years, and 16.1 at five years to 24.2 at six years.

Discussion.—The use of the pencil in this simple occupation is of great interest to the children, and the test seems to measure real differences in the ability to pick out as well as to mark forms.

Motor Coördination

For studying motor coördination as relatively uncomplicated by such factors as form perception, a group of six tests was used. These are the Porteus maze, three hole test, perforation, the walking board, Montessori dressing frames, and tracing path. The results are presented in Table IV.

Porteus Maze

A good general idea of a child's motor coördination may be obtained by means of the three blanks designed by Porteus.[109] They consist of a diamond, a Maltese cross, and a four-pointed star, all outlined with double lines.

In our experiment the examiner sits beside the child at a low table and, showing the cross, says, "See, here is a game." The examiner then begins to draw slowly between the double lines, saying to the child while drawing, "This is the way we play it. You start here and draw a line between these two printed lines. You try to make it nice and straight and try not to touch the sides or the corners." After completing the drawing the experimenter takes a fresh sheet, again the cross, and lays the pencil down before the child saying, "Now you do this one just as carefully as you can." The experimenter notes the time and observes the child's manner of grasping the pencil and its general reaction. After the child has drawn the cross it is given the diamond and then the star, both without further illustration, merely with the instructions repeated. Only one trial is given on each design. An objective method of scoring was worked out by us as follows: The space enclosed within each of the figures is divided into a number of equal zones. In the cross there are 60 such compartments, in the diamond 44, and in the star 36. For each design a compartment is scored plus when the child's line enters within bounds between the printed black lines, and remains so throughout the compartment or zone. When the child's line leaves the bounds in any compartment or is out of bounds throughout the zone, that compartment is marked minus. The composite score is the algebraic difference.

Observational Notes.—Most children grasped the idea of what was required and appeared to be making some effort. An undeveloped child frequently failed to understand that it must keep between lines or was unable to continue around the design, working instead in sections or beginning again at the upper part to finish the right-hand portion. The older children held the pencil correctly and appeared to be taking pains to keep within the lines. A very young child usually held the pencil like a hammer and had difficulty in getting the lead to mark, merely waving it around and making jabs and scratches. Despite the caution to go carefully there were great differences in the time used by the children, the rate varying from 3 to 120 seconds.

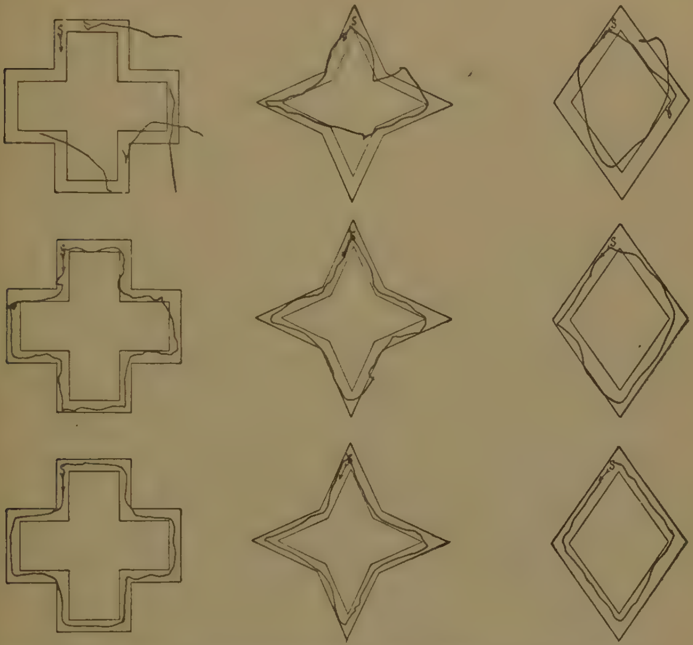


FIG. 23. THE SMALL HANDS FOLLOW THE OUTLINES WITH DIFFICULTY.

Results.—For the two-year-olds the diamond is the only figure that yields a positive score. All three figures reveal a good score at three years and a rapid increase between three and four years, with a more gradual increase between four and five years. At five and at six years the average performance is almost perfect. Figure 23 gives some specimen records.

Discussion.—The test was roughly scored by Porteus as follows:

For the three-year test, the diamond, ''ability to understand instructions and to make some attempt at tracing the outline registers a pass. Children below this mental level, move the pointer wholly at random.'' For the four-year test, the cross, ''fidelity to outline is expected.'' For the five-year test, the star, ''if more than two corners are missed—the pencil running outside the guide lines—a fail is recorded.''

In regard to this motor test in general Porteus thinks that the child who cannot do this test ''has so little ordinary prudence and foresight that while he gives his undivided attention to the movement of the pointer he fails to anticipate changes in direction and consequently rounds off the corners, in many cases cutting across in such a way that the angles disappear and the curves take their place. . . . Another possible explanation of the child's failure is that its perceptions are so blunt that it does not actually see the outline but sees the object in mass. Poor motor control may of course militate against the child's success. It is not evenness of line, however, that is required but fidelity to outline.''

In the first three tests, at least, ''prudence and foresight'' are of considerably less importance than this factor of motor control, which makes fidelity to outline impossible for the young child because of the difficulty of turning corners when the child understands perfectly the necessity for a change in direction.

The relative difficulty of the designs seems to correspond with the order given by Porteus, first the diamond, second the cross, and third the star. Notwithstanding the fact that the drawing of a square, involving vertical and horizontal movements, is easier than the drawing of a diamond, involving slant movements, the average performance of all children on the diamond was 91 per cent correct, on the cross only 84 per cent correct. The average performance on the star was 82 per cent correct. As the cross was given first in our experiment, this lower score may have been due partly to the difficulty of adjustment to the new test. It is extremely difficult to judge in any individual case by inspection alone which design the child did best.

FIG. 24. IT IS HARD TO FIND THE HOLES.

Even with the more objective scoring the designs could hardly be considered as a scale of equal steps and thus diagnostic of mental ages three, four, and five years. The designs are, apparently, a useful means of differentiating children above and below three years, and the tests furnish much incidental material for judging the child's motor development by the way in which the pencil is grasped and manipulated.

Three-Hole Test

The ability to make fine well-coördinated movements has been studied in adults by means of the familiar aiming and tapping board described by Whipple.[148] For our work with young children only the three-hole part of the apparatus is used. The child is required to put a stylus into each of three holes set in the form of a triangle (Fig. 24).

The board is wired in circuit with a clock counter which is not used to record the contacts, however, but merely to act as an incentive to the child, since putting the stylus into the hole makes the apparatus "tick." The brass plate has been removed from the top of the board containing the holes in order that contact shall not be made until the stylus actually touches the metal at the bottom of the holes. The child is seated before the apparatus and the experimenter says, "You see this pencil. When I put it into the bottom of the hole it makes a click. Now I will put the pencil into the bottom of each of these three holes, just one time into each, and keep on going around. [The experimenter goes around the three holes twice clockwise.] Now you do it and see how many times you can make it tick before I tell you to stop." The time allowance is one minute. The experimenter makes small pencil strokes to keep record of the number of times the child puts the stylus into the holes and keeps notes on the manner of performance.

Observational Notes.—Observation of the children as they performed the test revealed many interesting qualitative differences in motor development. Some of the children held the stylus awkwardly, rather near the end. Others held it in the clenched fist. The majority had difficulty in putting the stylus into the holes, feeling around the hole and finally sliding the stylus in. A number did not get the point firmly into the hole, thus causing a series of clicks. The older children worked systematically around the holes in rather an automatic manner. The younger children evidently had difficulty in remembering which hole they had just done, for they reversed the order of touches, worked between only two of the holes, or even went twice into the same hole. They had a tendency to look at the examiner for approval or to stop at the end of each complete circuit.

Results.—The average number of times the stylus was inserted in the hole increased from 15.6 at two years, 20.1 at three years, 27.6 at four years, and 35.0 at five years to 38.4 at six years.

Discussion.—It is evident that the three-hole test is a very difficult one for little children because they do not have sufficient motivation or do not understand what it means to get a large record and consequently can not see what progress has been made. A high score in the test is evidently dependent not only on actual skill and speed in motor performance, but also on the ability to keep some such abstract notion of success in mind and the willingness to concentrate on the task.

Perforation Test

An adaptation of the three-hole test was devised by us to furnish a motor test with a visible record of progress intelligible to the young child. This consisted in punching holes in paper, a fascinating occupation. Town [141] found a similar occupation successful with children from five to six years.

The material for our test consists of a sheet of bond paper on which is outlined a checkerboard of holes at 2 cm. distance. The imprint of the holes is made by punching through a master pattern with a punch that makes a broken circle, the circumference having been filed away at two points. The sheet containing 50 holes is held taut between two frames clamped at three points to the two sides at the corner of a low table where the child and experimenter sit. The experimenter has a similar sheet on her lap and says, "See, we're going to punch through these holes with this stick," an orange wood stick cut short and flat at the smaller end, so as just to punch out the holes. The experimenter punches two rows of holes, saying, "We do first this row and then the next," and then gives the child the stick saying, "Now you see how many holes you can punch on your paper until I tell you it's time to stop." The time limit is one minute. Three trials are given as nearly as possible on successive days. The score is the number of holes punched in one minute.

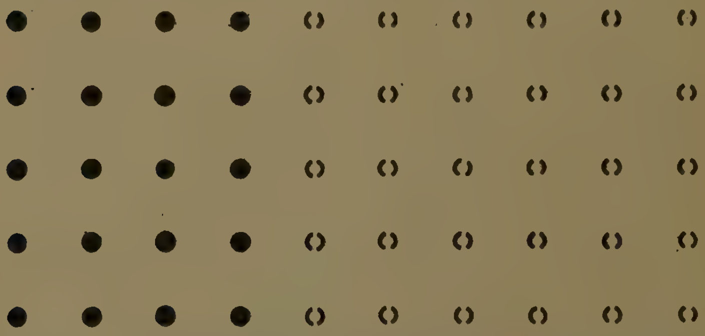


FIG. 25. PUNCHING TWENTY HOLES IN PAPER IN ONE MINUTE IS ONE TWO-YEAR-OLD CHILD'S ACCOMPLISHMENT.

Observational Notes.—As with the three-hole test, the children's motor development was apparent in the general method and performance. Those who were more advanced held the stick like a pencil, either in a comfortable position at the middle, or a little awkwardly, too near either end. The younger children held the stick as a baby holds a spoon, with tightly clasped fingers, thumb down, or even in the reversed position with thumb up. The children generally rested the wrist and part of the hand on the paper. Beyond the instruction to do row after row no attempt was made to get the children to follow any plan. Some began at the top and some at the bottom. Some went systematically, others here and there, and some along the edges only. Figure 25 shows a specimen performance.

Results.—Considering the results from the first trial only, we find that the two-year-olds average 21.7 holes, the three-year-olds 18.7, the four-year-olds 24.0, and the five-year-olds 32. The six-year-olds drop back to 27.7.

FIG. 26. THE FEET TOO HAVE TO LEARN.

For fifty-three children who had three trials at the test the average scores were 23.9 for the first trial, 25.9 for the second, and 27.3 for the third. The ability to do the test does not on the whole increase much with this practice. In fact, some children lose at one or the other of the trials.

Discussion.—The resemblance between the average scores on the perforation and on the three-hole test shows that the two measure very much the same functions. Although the perforation test has the advantage in motivation, it probably penalizes careful work, as too great care in trying to get exactly into the middle of the hole limits the amount done. Consequently the younger children who went more or less hastily, slipping over the paper into the holes, got more done. The test could be adapted so as to penalize such carelessness; it merits further development because of the undoubted appeal it makes to young children.

Walking Board

The age of walking and of developing general bodily control has long been recognized as being of importance in evaluating a child's physical and even its mental acceleration. So also, the ability to perform various acts of skill, such as standing on one foot, going upstairs and downstairs, or walking on a slightly elevated board or rail, is a good index of general development (Fig. 26).

A walking board test described by Johnson [66] has been modified at the Station.

Our apparatus consists of a board 2.5 m. long by 6 cm. wide. This is set up on edge and supported by four braces resting on the floor. The top surface of the rail is 10 cm. from the floor. On the surface along one vertical side is a series of marks to permit of reading the distance the child has walked. These marks are 10 cm., 5 cm., and 2.5 cm. divisions, with numerals from 1 to 25 to permit of easy reading. The child is placed before the proper end of the board, and the experimenter says, "See this board. See if you can walk on top of it, way up to the end. If you step off, step right on again at the same place and keep on walking until you get to the end." No support or help is given except that the child is encouraged to step back on to the board when it falls off. This is done, however, only after the first two step-offs. The stop watch is started when the child puts one foot on the board and is stopped when the child finally steps on the floor at the other end of the rail. At each step-off the experimenter records the distance covered, the reading being taken at the toe of the shoe. It is not feasible to make the child get on the board again at exactly the point it falls off, but the place is approximated as nearly as possible.

Notes are kept of the child's manner of walking and these, together with the number of step-offs and the time, are taken into account in scoring. Johnson uses only the number of step-offs, but this method of scoring makes no provision for the child who never steps off but walks the entire board with a poor method, for example, without alternating the feet or by sliding along sidewise. To supply a more differential means of scoring, the following point scale was worked out: Score 0 points for the child who refuses to try. In the few cases in which this occurs the examiner demonstrates and sometimes gets another child to perform to show that no harm can befall the walker. The child usually remains timid and is not forced to try. Score 1 point for the child who, although it overcomes its timidity sufficiently to put one foot on the board, often can not keep the other on long enough to take a real step and so continues walking in this manner up to the end of the board. This performance denotes a higher degree of development than exists in the child who knows it can not do it at all. Score 2 points for the child with a slightly better degree of development who stays on the board, but only by turning sidewise and sliding along with the feet at right angles to the board. Score 3 points for the child in the next stage in development, who walks the board as a young child skips or goes upstairs and downstairs, one foot always before the other, never alternating. Score 4 points for the child who alternates the feet, but walks very slowly with many step-offs and with little space between the feet or with the toes turned far out. Score 5 points for the child who walks rapidly and confidently with long steps and few step-offs.

Observational Notes.—Some children began with the feet very close together, but as they got more bold took longer steps and walked faster. The arms were generally held extended sideways, and the timid child clutched at anything within reach, resting the feet on the supports as they were reached.

Results.—No two-year-old children were tested. At three years the average score was 2.3, at four years 4.2, at five years 4.8. Beyond this there was no increase. The greatest increase took place between three and four years.

Discussion.—The experimenter has to use considerable judgment in deciding which method predominates. As many children got the perfect score, further differentiation should be made at the upper end of the scale, probably on the basis of short time and few step-offs. In the absence of sufficient data it did not seem wise to do this at present.

The test is probably highly correlated with maturity and general motor development. If it were standardized in such a way as to permit of better scoring, it would prove a useful addition to an array of motor tests. We are now working on a series of walking boards of graded height, length, and thickness which the child will walk one after the other until the limit of its performance is reached.

Montessori Dressing Frames

One very interesting and practical way to test the development of motor coördination is to observe the extent to which a child can dress itself. Montessori [90] has devised a set of frames for practice in these operations. We have given frames A to G to the children under experimental conditions and noted the time and the errors or successes in completing a set of seven frames (Fig. 27).

The frames, 12 inches by 9 inches, with rounded corners, resemble the wooden frames of school slates. Tacked over each frame are two pieces of material with hems at the inner edges to be fastened together in the specified manner, by laces, snaps, buttons, hooks and eyes, or tapes. The frames are presented to the children one at a time, in the vertical position, with the left-hand flap overlapping the right-hand one when fastening is completed. The children sit before a low table on which are laid two frames, the shorter side toward the child, fastening undone. The experimenter picks up the demonstration frame and says, "Do you know how to button [or lace, or fasten snaps, as the apparatus demands]? You watch me fasten this up." [Does it.] "Now you do yours." The sample frame is left in sight. Three minutes' time is allowed for all the frames except Frame B, for which five minutes is allowed. Notes are kept of the child's manner of performance. Frames A, B, and C are given at one sitting, the remainder on another day.

Frame A.—In this frame six buttons 7/8 inch in diameter were sewed on the edge of one piece of calico with corresponding buttonholes on the edge of the other piece. The majority of the children said they had had experience in buttoning. The average number buttoned was 2.1 at three years, 3.8 at four years, 5.8 at five years, and 5.9 at six years. The greatest improvement came then, between three and five years.

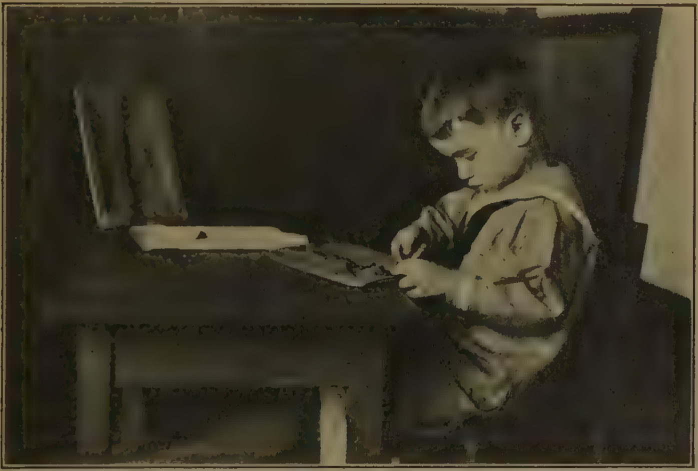


FIG. 27. AFTER LACING COMES BUTTONING.

Frame B.—This frame, covered with denim, had sixteen shoe buttons and worked buttonholes to be fastened with a buttonhook. A good many of the children said they did not know how to use a buttonhook and never buttoned their own shoes. These children usually wanted to button the shoe buttons with their fingers. It was surprising, therefore, to see how easily they learned to use the buttonhook. The age scores jumped from 3.9 buttons at three years to 8.1 at four years. At five years the score was 9.9 and at six years 14.7.

Frame C.—The denim covering this frame was pierced with twelve pairs of metal eyelets to be laced with a shoe lace. The child is shown how to lace in the conventional manner, putting the lace into the holes from below. When shown the conventional method of lacing and asked if they could do it, the majority of the children said they knew how to lace their shoes, but when this was put to the test it appeared that any sort of putting of laces into holes was called lacing. Some of the children merely wound each lace around its own side without crossing. Others skipped holes and afterwards went back to them, tangling the laces in a hopeless fashion. The test was scored by giving 1 for each hole correctly entered, that is, coming from the correct hole and entering the correct hole, as the test required. The age scores increased from 4.9 holes at three years, through 6.6 and 12.9, to 17.8 at six years.

Frame D.—The denim in this frame was pierced with six pairs of metal eyelets to be laced with a shoe lace. The laces are put into the holes from above. This type of lacing was a failure with most of the children since they did not really understand the method. The lacing in Frames C and D makes entirely different patterns, which, however, the children usually did not distinguish. The averages were only 1.8 holes at three years, 2.9 at four years, and 3.8 at five years, with an increase to 10.5 at six years.

Frame E.—This frame was covered with calico on which were sewed nine pairs of medium sized metal snaps of the type used instead of hooks and eyes. Almost all the children were familiar with the modern ''snap'' fasteners. The age scores increased from 4.6 snaps fastened at three years to 7.6 at four years, with 8.6 and 9.0 as the later scores.

Frame F.—On the calico covering of this frame were sewed seven pairs of medium sized hooks and eyes. The children found the hooks and eyes the easiest material. The age scores were 4.3 hooks at three years, 6.4 at four years, and perfect beyond that.

Frame G.—Six sets of tapes 9 inches long for tying bow knots were sewed to the edge of the denim on this frame. The younger children were unable to tie even the preliminary knot, but wound the tapes around and around. Thirty-two of forty-six children failed to tie a bow knot. One child tied one bow knot within the time limit, one tied two bow knots, three tied three, three tied four, and six tied six. It is evident that even after the child understands the operations involved, the factor of speed is of great importance. The age scores show that there is no ability to do the test before four years. The average is a little over 1 at four and five years with an average of 2.9 at six years.

Discussion.—The ability to perform any of the operations tested by these frames seems to depend less on actual motor development than on previous experience. One or two of the very young children were obviously too undeveloped to use their hands efficiently, but some very young children who had been taught how to dress themselves could do more than other older ones who had been dressed like dolls. A simplified form of Frame A in which only two or four buttons are to be fastened is being standardized for two-year-old children at the Merrill Palmer School and at the Iowa Child Welfare Research Station.

Tracing Path

The individual differences in the ability to execute tracing movements revealed in such tests as the Porteus maze seemed worthy of more intensive investigation. A study is being made with a tracing path under the direction of the writers by Beth Wellman, research assistant in the Iowa Child Welfare Research Station.

The material consists of sheets of paper on which are printed two lines 25 cm. long, 5 mm. apart at the top and 1 mm. apart at the bottom. The paper is fastened by means of thumb tacks to a large sheet of beaverboard laid on a table. The directions are as follows: "See this pencil. I want you to make a mark right down the path like this. [The experimenter demonstrates how to follow the path by drawing an imaginary line from 0 to 25.] Keep right in the path all the time." Eight positions are used, with three trials for each position: down, left to right, up, right to left, angle of 45 degrees from right to left down, angle of 45 degrees from left to right down, angle from left to right up, angle from right to left up. Four movements of three trials each constitute a day's performance. Both the right hand and left hand are tested for each child. The method of scoring is to measure the length of the line within the path and the total line made and to compute the percentage of the total line which is within the limits. A simple measuring apparatus in the form of a wheel has been devised for this purpose. The average of the three trials is considered the score.

Observational Notes.—Differences were found in the method of grasping the pencil and in the muscular adjustments made. There were marked individual differences in the ability to remain in the path when the tracing was done in the various directions, but there was a tendency to greater uniformity in the performance with either hand as age increased. With the left hand both younger and older children showed considerably less skill than with the right hand. This difference became greater with increase in age and greater specialization in the use of the right hand. The first trial was in half the cases the best of the three and took the longest time for performance.

Results.—Since complete results of this investigation will be reported in a special monograph, the values reported in

Table IV are for the downward movement, right hand only. This test was found to be applicable to children from two and one half to six years of age. The youngest child who succeeded in making a score was two years and seven months old. The average percentage in path was 53.5 at three years, 72.2 at four years, 79.8 at five years, and 86.3 at six years. The five-year-old children spent on the average about three seconds longer on each trial than the two- to four-year-old children, the average for five-year-olds being 13.5 seconds and for the younger children 10.6 seconds.

Discussion.—This tracing path furnishes a practical method of analyzing the development of motor control in children after two and a half years of age. The results have a direct bearing on the age at which handwriting may be started, on the relationships among the body, arm, and finger movements, and on the types of individual muscular adjustments involved in these special movements.

CHAPTER V

MENTAL DEVELOPMENT: EXPERIMENTS IN PERCEPTION, ASSOCIATION, AND LANGUAGE

Visual Memory

THREE tests which can for convenience be grouped together because they contain a large visual element are the Knox cube, the adaptation board, and the picture memory test. The results are presented in Table VI.

Knox Cube

This test, in which four black cubes separated by equal spaces are to be tapped with a fifth cube in a certain definite order (Fig. 28), as shown by the experimenter, is given according to Pintner's standard procedure for the revision of the test, as described by Pintner and Paterson.[108] For the first "line" the examiner taps the first, second, third, and fourth cube in that order and then asks the child to do the same. For each "line" successfully imitated a score of 1 is given. There are twelve prescribed "lines" as follows:

1234
12343
12342
1324
1432
1423
13243
14324
13124
143124
132413
142341

Observational Notes.—The younger children had difficulty in grasping the idea of serial tapping; they merely pounded on the blocks or played "train" or "bridges" with them. The older children seemed to be more successful in paying close attention to the movements of the experimenter, but after they had reached their span they were entirely confused. Each child was asked after the test whether its performance was correct and how it could tell which block to tap. Almost all the children thought they had been successful, even in the face of obvious failure.

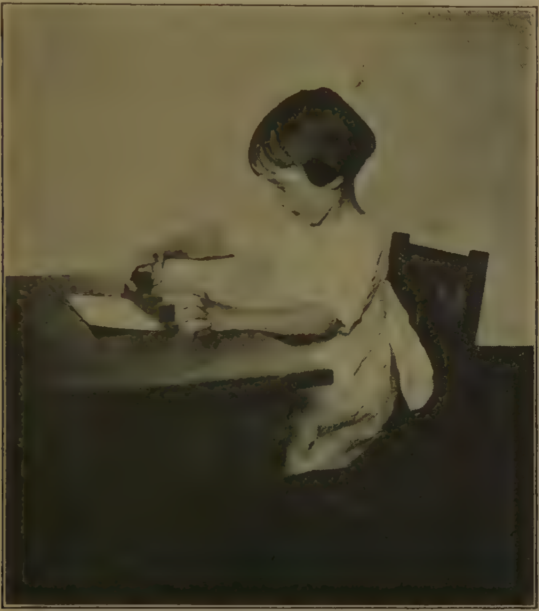


FIG. 28. THE ORDER OF TAPS IS IMPORTANT.

Those who had succeeded could give no clew to their method, but said they "just knew." No child seemed to have discovered the device of numbering the blocks.

Results.—The age averages are less than 1 line correctly repeated at two and at three years. At four years the average is 1.4, at five and six years 4.3. Pintner and Paterson's 50 percentile score is 1 line at three and four years, 2 lines at five years, and 4 at six years.

TABLE VI. — RESULTS BY AGES FROM PSYCHOLOGICAL EXPERIMENTS ON 105 CHILDREN

AGE		2 YEARS			3 YEARS			4 YEARS			5 YEARS			6 YEARS		
TEST		CHILDREN	RESULTS		CHILDREN	RESULTS		CHILDREN	RESULTS		CHILDREN	RESULTS		CHILDREN	RESULTS	
			Average	Range		Average	Range		Average	Range		Average	Range		Average	Range
Knox Cube	Score . . .	4	0.3	0-1	28	0.4	0-2	14	1.4	0-4	9	4.3	2-6	6	4.3	1-8
Adaptation Board	Score . . .	4	1.8	1-2	28	1.5	0-3	22	2.1	0-5	10	2.9	1-5	6	3.3	2-4
Picture Memory	Score . . .	5	0.8	0-2	26	4.5	0-13	22	8.0	0-13	30	11.1	5-15	13	11.5	8-14
Manikin	Score . . .	6	0.0	0-0	35	0.7	0-3	21	1.5	0-5	29	3.5	1-5	10	3.4	2-5
Picture Completion	Score . . .	4	1.3	0-5	27	22.6	0-121	14	30.4	0-121	10	100.4	0-376	5	47.6	1-120
Ship	Score . . .	3	0.0	0-0	14	2.4	0-8	18	4.6	0-17	29	8.3	0-20	17	12.8	4-20
Color Discrimination	Score . . .	3	10.3	9-11	22	12.3	0-36	15	22.5	7-40	10	38.5	37-40	6	35.8	23-40
Color Card Sorting	Score . . .	0			14	26.3	0-56	16	48.8	31-92	10	64.9	48-91	11	79.7	54-120
Color Naming	Failures . .	0			5			1			0			1		
	Time, seconds				6	159.7	344-99	15	142.1	290-73	9	92.4	136-71	8	92.1	201-65
Picture Vocabulary	Score . . .	5	19.2	5-27	26	29.7	12-41	21	38.0	28-45	29	44.0	37-49	14	45.6	40-50
Picture genus	Score . . .	1	7.0	7.0-7.0	8	10.5	0-35	8	32.5	26-40	6	33.2	17-40	14	37.6	32-40
Design																
Sight	Score . . .	2	0.5	0-1	4	7.8	2-12	10	12.6	4-18	8	17.1	11-18	9	16.1	7-18
Memory	Score . . .	0			5	5.6	3-8	8	14.3	11-18	4	16.5	14-18	15	16.3	2-18
Weight Concept	Score . . .	0			14	11.6	3-15	17	13.0	11-15	9	13.5	11-15	11	14.3	12-15
Number Concept																
Test 1	Score . . .	2	1.0	1-1	26	2.4	0-6	27	4.7	0-8	20	6.3	1-9	18	7.5	4-10
Test 2	Score . . .	2	1.0	0-2	26	3.4	0-13	27	10.6	0-38	20	23.7	7-100	18	25.3	1-99
Test 3	Score . . .	2	0.0	0-0	26	2.1	0-11	27	9.2	0-40	20	21.3	1-53	18	27.6	3-53
Test 4	Score . . .	3	0.7	0-1	10	0.8	0-2	14	1.2	0-4	19	2.4	0-4	22	3.4	0-4
Test 5	Score . . .	3	0.7	0-1	10	1.2	0-4	14	3.6	1-6	19	4.1	1-7	22	5.6	3-10
Test 6	Score . . .	3	1.3	0-3	10	1.3	1-3	14	4.6	2-10	19	7.0	2-10	22	7.9	3-10
Time Sense																
Test 1	Score . . .	1	0.0	0-0	8	3.8	1-6.5	9	8.8	1-16	8	16.4	8-24	14	20.5	9-28.5
Test 2	Score . . .	1	0.0	0-0	8	2.6	0-6.0	9	4.2	1-11	8	8.2	2-15	14	10.5	3-15.5
	Total . . .	1	0.0	0-0	8	6.4	1-11.0	9	13.1	2-27.5	8	24.7	11-37	14	31.1	11-43.5

Discussion.—The Knox cube test is an abstract one requiring a good deal of concentration and consequently did not prove popular with the children. Although it involves visual and kinæsthetic elements, the test resembles that for auditory digit span. It depends to some extent also on the development of the number concept. An imperfect differentiation of 3 and 4 would make it impossible to perform.

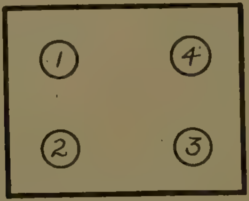
FIG. 29. WHEN THE BOARD IS TURNED AROUND, HE STILL REMEMBERS WHERE THE BLOCK FITS.

A simpler form of test with two or three blocks would probably bring a greater percentage of success with the younger children.

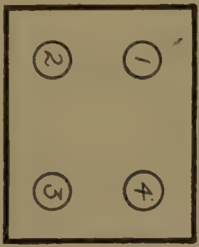
Adaptation Board

Another performance test that depends to some extent on the development of the spacial perceptions and on visual and kinæsthetic memory is the Goddard [52] adaptation board with four holes, three of them the same size and one larger, and a wooden block that fits the large hole exactly (Fig. 29).

In the method adopted for this study the child sits beside the examiner at a low table on which the board is placed, the largest hole in the upper right-hand corner. The experimenter says, "Do you see this round block? It doesn't go in here, does it? [trying to fit it into hole 1], and it doesn't go in here [hole 2], or here [hole 3], but it just fits in here [hole 4]. Now you put it into the hole it really goes into." The caution, "Don't try the others but just put it into the hole it belongs in," is necessary in some cases where the children seem to be trying all the holes just for the fun of putting the block on the board. Such enjoyment in manipulating is a strong interest with young children. When the child has placed the block into hole 4, either at once or by experimenting, the examiner says, "That's right; now watch carefully and see what I'm going to do with the board." The examiner turns over the board so that hole 4 occupies the position formerly held by hole 3, the lower right-hand corner. "Now you put the block where it really belongs." A score of 1 is given only if the child at once correctly places the block. Then the examiner says, "That's right; now watch carefully," and turns the board over from right to left so that hole 4 occupies the position originally held by hole 2, the lower left-hand corner. A score of 1 is again given only if the child at once correctly places the



block. If the placing is not correct the child is allowed to work by trial and error again until the right hole is found. The experimenter then turns the board so that hole 4 holds the position originally held by hole 1, the upper left-hand corner. The final move consists in turning the board upside down and turning it 45 degrees so that hole 4 occupies the lower right-hand corner, thus:



One point is given for correct placing at each move. Goddard appears to have turned the board back with hole 4 in the original position after each move. This probably makes it much easier to remember, or visualize, the position of the large hole.

Observational Notes.—The children liked the test and usually felt quite certain that they knew where the hole was after each move. When they found they were mistaken they tried one after another of the holes, sometimes by trial and error, sometimes systematically going around. Some children never seemed to understand that the positions of the holes changed with each move of the experimenter. They repeatedly tried the block in the place where it had fitted on the first or the preceding trial.

Results.—Almost all children succeeded in placing the block at the first move after the initial demonstration. The average is only a little over 1 move at two and three years. At four years it is 2.1, at five years 2.9, and at six years 3.3. Pintner and Paterson's 50 percentile at four years is 1 move, at five years 2 moves, and at six years 4 moves.

Discussion.—The adaptation board test received its name because of its dependence on the ability to adapt oneself rapidly to a changed situation, an ability known to be highly correlated with intelligence. As in the Knox cube test, success apparently depends upon attention and observation of the experimenter's movements with ability to remember them. The ability to visualize or to reason out the new position of the hole is an important factor. A realization that the hole is about to change position probably facilitates concentrated attention to the movements of the board and of the hole as it rotates to its new position. A child often scores a success on the last move after several failures because of a better understanding of the need of close attention.

FIG. 30. RECALLING THE BIRD SEEN IN THE FIRST PART OF THE EXPERIMENT.

The test is a reproduction in simplified form of different types of complex situations in real life, such as foreseeing what will result from certain movements in paper folding or pattern making. The ability to make similar transpositions of visual images is involved in solving Binet's paper cutting test, in understanding the operations of geometry, and in imagining the reversal of the hands of the clock.

Picture Memory

Experiments on phenomena of memory are of great interest in view of the traditional belief that memory in a young child is relatively weak. Town[141] worked with familiar objects in testing the recognition memory of children from five to six years. For work with our younger children we devised a picture memory test (Fig. 30).

The material for this test consists of a practice card, five stimulus cards, and a memory chart. On the cards, 8 inches by 5 inches, are pasted one, two, three, four, or five pictures, five rows of ten each. The pictures, approximately 1 inch square, are black and white outline drawings of a variety of common objects cut from several test blanks in common use for young children. The cards have pictures as follows:

1. One picture (elephant) to be used for practice
2. One picture (bird) to be used for testing
3. Two pictures (kitten, candlestick)
4. Three pictures (fish, sun, flower in a pot)
5. Four pictures (umbrella, camel, shoe, evergreen)
6. Five pictures (sailboat, hat, soldier, rooster, clock)

The child sits before a low table on which lies the memory chart folded in half like a book. The experimenter shows the practice card, an elephant, for five seconds, saying, "Look at this very carefully." At the end of the exposure time the experimenter takes away the practice card, opens the memory chart and says, "Now you look at these and find that same picture I just showed you." The experimenter then starts the stop watch. If the child does not succeed in finding the elephant within two minutes, the stimulus is shown again and the search continued. After the elephant is found, the experimenter says, "Now I am going to show you another picture and then I'll take it away and you must find it for me." The experimenter exposes the first test card five seconds and then allows the child to hunt for it on the memory chart. After it is found or the child obviously is unable to find it, the experimenter says, "Now I'm going to show you two pictures," and exposes the next card ten seconds. "Now you find them in here." The same procedure is followed for the remaining cards, fifteen seconds being allowed for three pictures, twenty seconds for four pictures, and twenty-five seconds for five pictures. A score of 1 is given for each picture remembered, whether this is presented alone or together with others on the same card. The time spent by the child in hunting is recorded, and notes are kept of the general manner of performance. No use is made of the time, this being apparently a characteristic of the individual not connected with accuracy of memory.

Observational Notes.—Almost all the children named the stimulus pictures as they looked at them, repeating the series several times until the card was removed. The name seemed to be an important element in success in finding the object. Some children searched systematically, going from picture to picture along the rows, sometimes pointing and naming objects, saying, ''That's not it, that's not a bird.'' If the child had forgotten the stimulus object, there was small chance that recognition would function. A good deal of confusion was discernible as the trials went on, the children thinking they had just seen an object, whereas actually it had been presented on a previous stimulus card. Occasionally a child recognized an object as having been presented in some previous trial. There was a tendency to point to several objects in the neighborhood of one that had been correctly located. There was also a tendency to confuse somewhat similar or related objects, such as the lion or fox for cat, gun for soldier, and so forth. A child frequently remembered an object that it could not find on the chart. Some of the children seemed to have a definite span beyond which they could not remember. The older children remembered the number of objects they had seen and were not satisfied until they had found the entire number.

Results.—The age scores show an average of less than 1 picture remembered at two years but increase thereafter to 4.5, 8.0 and 11.1. At six years there is not the expected increase, this average being only 11.5.

Discussion.—The picture memory test seems an excellent one for measuring some of the more complex processes in memory and recall. As a measure of memory span it separates the more mature and intelligent children from the undeveloped. It could easily be adapted for group use.

Apperception

A certain number of psychological tests appeal to the somewhat mythical ability known to Ebbinghaus as *Kombinationsfähigkeit.* Whether or not there is any such entity as apperception or the ability to combine parts into a whole, the so-called "completion tests" form an easily recognizable group. In a test of this kind the scattered fragments suggest some sort of complete whole; the child has to synthesize these scattered impressions, apperceive them as a whole, and plan to assemble the parts so as to reach a definite end. Among such tests we have studied the manikin, the picture completion, and the ship test. The results are given in Table VI.

Manikin

The manikin test described and standardized by Pintner and Paterson,[108] appeals especially to young children. It consists of wooden pieces representing a head, two arms, two legs, and a body, which, when put together, form a little figure resembling the gingerbread man of childhood (Fig. 31).

The experimenter places the pieces before the child in the prescribed order, saying nothing about its being a man, but merely asking the child to "put this together as quickly as you can." The test is scored on a 5 point basis, according to the degree of success in assembling the pieces correctly: 0 points, failure to see that the pieces make a man; 1 point, legs or arms interchanged or arms at side, or any other result that looks like a man; 2 points, two reversals, that is, both arms and both legs reversed; 3 points, one reversal, that is, right arm for left arm or vice versa, or right leg for left leg or vice versa; 4 points, one or both arms up or out, that is, not exactly fitting into the joints; and 5 points, absolutely accurate, a complete performance.

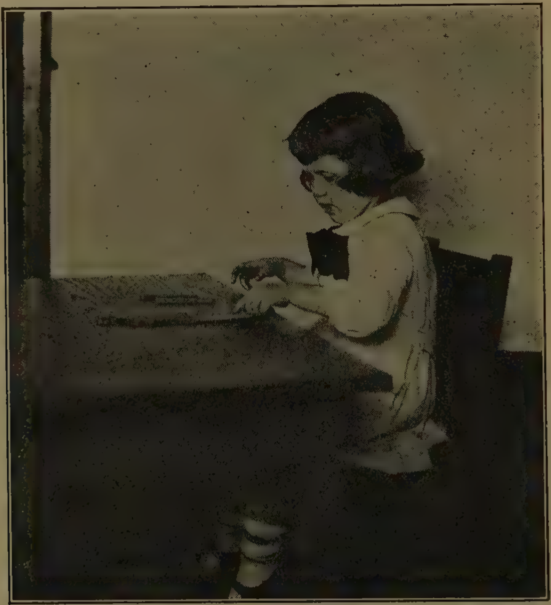


FIG. 31. THE BRIGHT CHILD SEES THAT THESE PIECES OF WOOD MAKE A GINGERBREAD MAN.

Observational Notes.—The children were delighted with the "game," even when they could not apperceive the man as a whole. Many of the children interpreted the directions quite literally and simply shoved the pieces together. The younger children often played with the pieces, arranging them in rows or piles, making something they called a house or an airplane. Those who were a little more developed frequently named the parts, or made attempts to stand the parts up on the table. One boy put the head on one leg and said, "He can walk on his leg." Even when the parts were named some children had no idea of how to go about assembling them. One child volunteered the information that "the car had run over the man and smashed him up," but still could not put him together again.

Results.—The two- and three-year-old children got less than 1 point. The average for four-year-olds was 1.5, which increased to 3.5 at five years, but the score did not increase beyond this. Pintner and Paterson's norms show 0 at two and three years, and 1.5 at four years. Their 50 percentile score for five years is 3, and for six years 4.

Analysis of the children's performance shows that there are four factors involved in the correct placing of all the parts: (1) perceiving that the disjointed pieces make a man and placing the parts in some position, making a figure resembling a man; (2) perceiving that the two pairs of limbs have separate functions, legs and arms; (3) perceiving the difference in form of the joint-ends of the two pairs of limbs, and assembling these parts in their proper geometrical relation to the body; and (4) placing the limbs at reasonable angles.

1. Examples of failure to understand that the pieces make a man are found in the following notes made as various children were examined:

E.F.: Just played with it. Fitted heel into hand. When asked, "What is this?" said, "It's a shoe," "skirt," "woman," but did not put it together. Wanted to make pieces stand.

I.M.T.: No idea of placing them. Recognized head as that of man; no idea of where to put it.

R.H.: Hesitated. Continually said, "I don't know." Named parts of face.

R.F.: Said, "It's a man," but did nothing constructive.
E.W.: No idea of putting it together. Said, "It's a man," when shown head.
G.R.: No idea of what the pieces are.

2. Examples of attempts to put the pieces together while confusing the position of the legs and arms are as follows:

M.B.K.: Put head on; put legs on like arms. Finally put arms on in place of legs.
H.M.: Legs for arms and extended arms for legs.
M.D.: Legs and arms interchanged.

3. The difficulty of getting the square joint into the square socket rather than into the round one is illustrated by the following cases, in which either one arm or leg or both arms and legs were reversed:

R.W.: Head and legs correct, arms reversed.
C.S.: Placed parts at irregular places instead of socket. Two arms wrong end in; child calls it "funny."
F.B.: Started putting leg into wrong socket and persisted. Asked, "Is it supposed to be here?" Finally left man with both arms and legs reversed. When asked, "Is it all right?" child answered, "They do not fit." Worked three minutes, but could not make them fit.
K.H.: Legs reversed, then corrected them.

4. Many of the children paid no attention to the angle of the arms, leaving them in the horizontal position. One little girl, when asked after the test was finished whether she was satisfied with the result, replied by adjusting the angle.

Discussion.—The results of the test with these young children suggest several changes in scoring. The present method does not account specifically for correct placing of two arms and head, or two legs and head, with other parts omitted. Three children made such a placement, while one placed the arms at the sides, but incorrectly. The score for this performance should be 3 points. Provision is not made for the right placement of two legs, the head, and one arm. The scoring does not account for the right arm in a lifted position. This should be considered correct. The present scoring does not provide for legs placed correctly but not fitted into sockets. This occurs only rarely since the child is interested in fitting the parts together tightly.

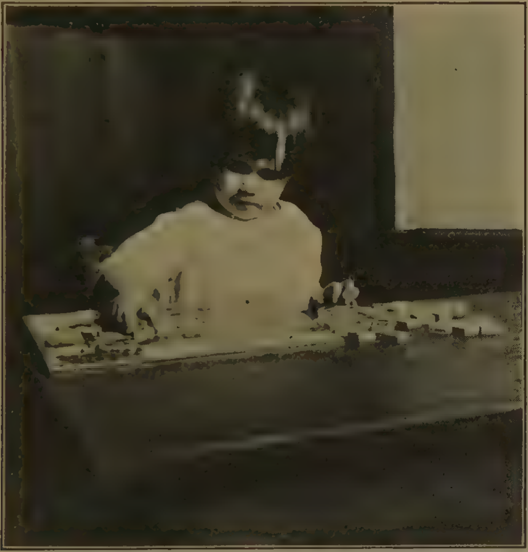


FIG. 32. ANY BLOCK FITS THE HOLE, BUT WHICH MAKES THE BEST STORY?

A simpler form of this test could easily be devised for young children by having only one or two missing parts or by omitting the geometrical complications at the joints.

Healy Picture Completion

Another test requiring the assembling of related parts is the Healy picture completion test (Fig. 32), given according to the standard procedure of Pintner and Anderson.[106]

The material consists of a picture, brightly colored, measuring 10 by 14 inches. It represents a barnyard scene in which ten simple activities are going on. There is no obvious connection between the activities, but each is of such a nature as to appeal to the childish imagination. A significant object necessary for the completion of each of the activities is omitted, and it is the task of the child to find the most appropriate object. For example, two boys are playing with a football; one has just kicked it into the air while the other is preparing to catch it. The significant object, the football, has been omitted and the blank space appears between the two boys. Or again, a boy is standing on a ladder plucking fruit from an apple tree and dropping it into a basket beneath. In this group the basket has been omitted.

Besides the ten most appropriate blocks there are forty others from which to choose, ten of which are blank, while the others bear objects. Each aperture for the blocks is 1 inch square, and the blocks are so cut that any one will fit in any space. No indication of the correct solution is made by the background of the picture, which is all of the same color and the same for every block. By this means it is possible to get some measure of the child's apperceptive ability, to see how well it is able to use its past experience in meeting new situations.

Observational Notes.—The children enjoyed playing with the material, but in general found the test too difficult. Very few of the scores represent more than accidental success, as was shown by the fact that no rational explanation could be given for the placing. Several children who placed the broken window correctly in the house called it a star. The children often seemed to understand the placing of the demonstration block (wheel fallen off the axle of wagon), but quickly forgot the purpose of the examination and placed the other blocks entirely at random. Some children did not notice until after placing the fourth or fifth block that there were pictures on the blocks. Some placed the blocks picture-side down or upside down. Others were guided entirely by the desire to find a block that fitted nicely in the hole. Such children, experiencing difficulty through having twisted the block so that it would not go in the hole, discarded it. One child complained that the blanks had no pictures and put them all aside. Most of the children had peculiar prejudices for or against certain blocks, trying a favorite, such as the fish or the bowl of flowers, in several places to see where it looked best, or discarding certain blocks at once without determining their appropriateness.

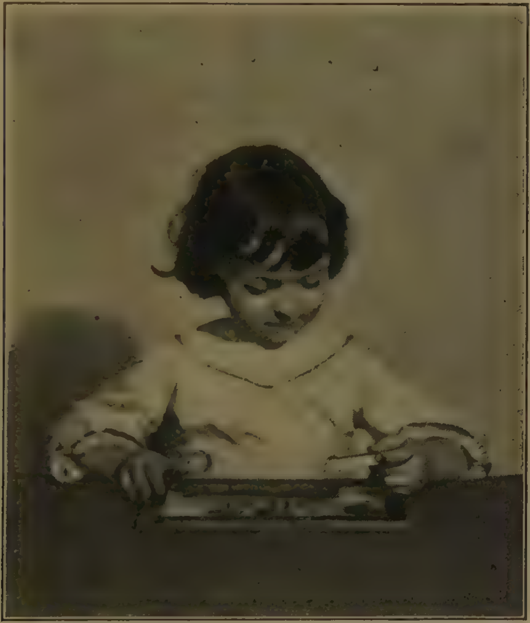


FIG. 33. THE TEN BLOCKS WILL MAKE A SHIP.

Results.—There is little or no success at two years. The age scores increase from 22.6 points at three years to 30.4 at four years, and 100.4 at five years, with a drop again at six years. The standardization does not give norms below five years, where the median is reported as 89.

Discussion.—The failures of these young children were probably due, as in the manikin test, to inability to correlate the separate perceptions into a unified whole. Their attention was distracted by the complexity of the situation and by the number and attractiveness of the blocks. A simpler form of test could be devised with a few situations and just enough blocks to fit all the holes, or with a single hole and a right and wrong block. The test might even be used in its present form by covering all the holes except one and presenting only a few blocks from which to choose the most appropriate. It would probably be better to have all the holes too large so as to eliminate the manual difficulty, and do away with the choosing of best-fitting blocks. In its present form the board seems to be inapplicable for use with such young children.

Ship Dissected Picture

A third test involving construction of a whole from scattered parts is the ship test devised by Glück and mentioned by Knox. It consists of ten rectangular pieces, all the same size and shape, which, when correctly fitted into a frame, form a picture of a ship at sea (Fig. 33). The test was given according to the standardized method of Pintner and Paterson.[108]

The test is placed before the child with the ten pieces in the prescribed order at the top of the empty frame. The examiner says, "Put this together as quickly as you can." The child is allowed to take its time in finishing the test, but the examiner is careful not to suggest that any changes need to be made.

A score of 1 is allowed for each of the lower or upper pieces if placed in the lower or upper portion of the frame, that is, the "water" pieces at the bottom and the "sky" pieces at the top. In addition, a score of 1 is given for any piece that is in correct position in relation to any other piece. The maximum score is 20, 10 for "sky" and "water" pieces, and 10 for each piece being next to its correct adjoining piece, that is, if two pieces are correctly placed with reference to each other the score is 2, if three pieces are thus placed the score is 3, and so forth.

Observational Notes.—The younger children showed little appreciation of the picture and were engrossed merely in filling the frame, sometimes in the order in which the blocks were presented. Some even put in a few pieces in the horizontal position, leaving no room for the remaining blocks. To the more advanced children in the group the picture became a matter of interest. One child who could not fit the blocks into the frame remarked that they were "pretty on this side." Children who noticed the pictures often seemed to think that each block represented a separate scene and that the completed picture had several ships. The more accelerated children often knew there was something wrong with their completion although they were unable to locate the difficulty.

Results.—The test was too difficult for our two-year-old children. At three years the average score was 2.4, at four years 4.6, at five years 8.3, and at six years 12.8. In the Pintner and Paterson norms there is a jump from failure at five years to a median score of 15 at six and at seven years.

Discussion.—The test is more difficult than the mare and foal test or similar picture boards with irregularly shaped inserts, but our results show that it is useful even below five years of age.

Perception of Color

Observations and some preliminary experiments on the development of the color sense and on color preferences were made by many of the older writers. Binet and others who have revised his scale studied the age at which the fundamental colors can be named. It is probable, however, that children recognize many colors they can not name. Two experiments on the perception of color were devised in the preschool laboratory. Table VI shows the results.

Color Discrimination

In order to study the development of the ability to recognize similarities among colors, we planned an experiment in sorting worsteds (Fig. 34).

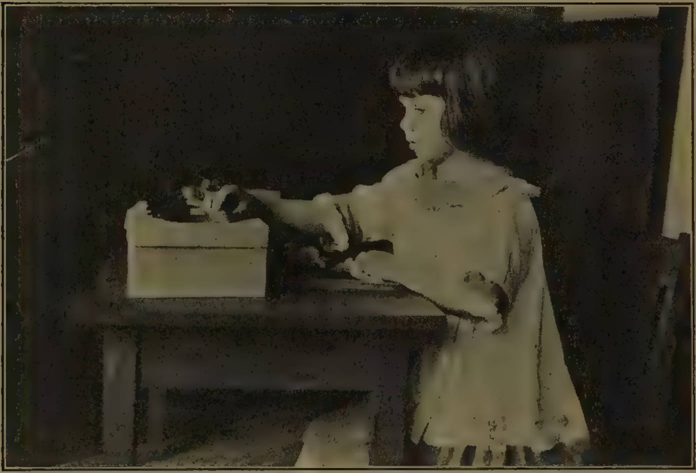


FIG. 34. SORTING SHADES AND TINTS OF VARIOUS COLORS.

The material consists of forty-four colors selected from the Holmgren color-blindness test series. Four sample colors are used, a vivid red, green, yellow, and blue, and ten shades and tints of each sample color. The colors used are as follows, the numbers and letters being those of the tags on the Holmgren worsteds:

Sample		*Tints and Shades*
Red	103	31, 89, 87, 75, 85, 71, 77, 29, 35, 33
Green	49	45, 67, 43, 5, 97, 53, 13, 15, 17, 19
Blue	76	24, 78, 90, 86, 88, 30, 72, 22, 92, 84
Yellow	Z	39, U, J, 40, R, 98, Q, M, 18, Y

Each of the sample colors is pinned on the lid of a gray pasteboard box. In each lid is cut an opening 1½ inches by ½ inch to permit the worsteds' being dropped out of sight into the box.

The boxes are arranged in a row with the colors red, green, yellow, and blue running from left to right. Between the child and the row of boxes is a tray containing the forty tints and shades to be sorted. The directions are then given in this form: "See these boxes? What is the name of this color? This——? This——? This—— [pointing to each sample]? See these lovely colors [showing colors in tray]? You must put each one in the box where there's one most nearly like it. [Experimenter picks up a green.] Where is the one that looks like this? [Experimenter helps place this one, if necessary.] Go ahead and put all the others in their right boxes. Take the easy ones first." If after much urging a child still maintains there is nothing like a certain color, the child is allowed to place it in the discard. No time limit is given.

Observational Notes.—All the children were delighted with the test material. Some of the younger children could not get the idea of the test at all, and maintained that the demonstration green was not like any of the samples. The majority of children seemed to understand the task, however, and started well, placing several colors correctly. Then the task was usually forgotten by the younger children and they began playing games of their own. One child piled all the colors into one box as fast as possible, looking down the slit to see how many were in; another tossed the little bundles into piles. Several got lost in various æsthetic projects, such as making nice neat rows, or pleasing color combinations on top of the boxes. Occasionally a child would return to real discrimination, usually with the more saturated colors, and place one correctly, even while playing some other private game. It was obvious that the poor success of many children was not due to the conditions of the test but to their stage of development. The older children were observed to be working much more systematically, often making an effort to collect first all worsteds of a certain color.

The saturated colors, especially green, were found to be the easiest, and the lighter pastel tints the hardest. Introspections and spontaneous remarks during the experiment showed that the children regarded tints and shades, such as pink and lavender, as separate psychological entities like the fundamental colors, and were genuinely puzzled by the difference between the sample and the color to be placed. They often said, "That's yellow and this is yellow, but they're not the same." If told, "Suppose you *had* to put the color in one of these four boxes, which is it most nearly like?" they sometimes were able to make the choice, but often maintained that the color to be placed was not like any of the samples. A little boy who had placed everything except three pinks suddenly announced with great delight, 'They are red."

Results.—The age scores increase from 10.3 correct placings at two years to 12.3 at three years, 22.5 at four years, and 38.5 at five years. The six year average, 35.8, shows a slight drop.

Discussion.—The test measures functions that are relatively independent of the ability to name the colors. Some of the younger children could not name the four samples, but placed a number of colors correctly. Other children could call even the more difficult tints and shades by their names, but did not know where to place them. The test is a little too difficult for our younger children, probably on account of the large number of colors to be sorted, which necessitates continuous attention for a considerable time. It does test some rather complex process of discrimination and comparison, however, and is consequently of value for measuring intellectual development.

Color-Card Sorting

Card sorting experiments with adults and with older children are mentioned frequently in the literature, but much of the material is awkward for little children to handle. With a view to studying the process of rapid discrimination between colors that are well known and the motor coördinations involved in sorting these colors, we devised a color-card sorting experiment (Fig. 35).

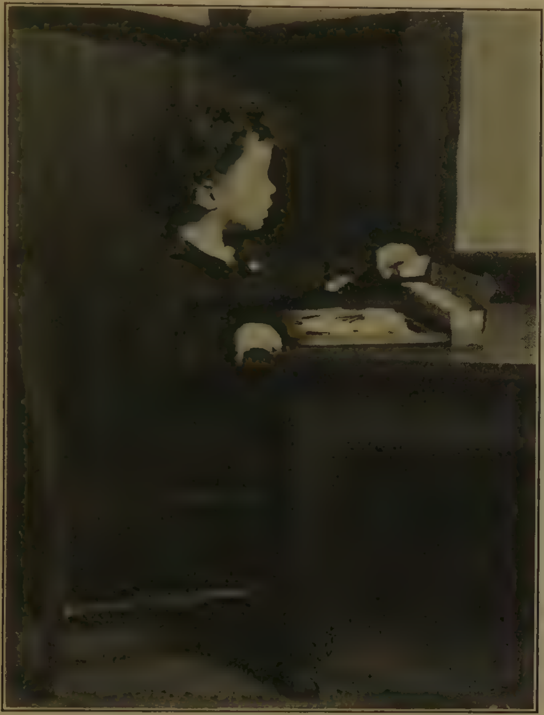


FIG. 35. SORTING CARDS BY COLOR.

The test material is a set of five pasteboard boxes about 1 inch by 2 inches and a pack of 100 small cards. On each card is mounted a color square [cut from the Woodworth and Wells color naming blank]. Each box is marked with a similar color square and boxes are arranged, from left to right, in the order yellow, black, green, red, blue. The cards are piled on the table in chance order within a wooden frame frequently used in other tests. The examiner says, "See these little boxes and these little cards. Let's see how many of the cards you can put in the boxes, each card in the box marked with its own color. Just take any card that's on top and put it in where there's one like it." A time limit of five minutes is given.

Observational Notes.—The children usually carried on a running conversation with themselves, saying, "This card goes in here; here's a red one, it goes there." Some children selected cards to go into a particular box, sometimes getting one for each box in serial order. Others picked up a card and then hunted the correct box for it. A number of the older children hit upon a time-saving method in the way of selecting a number of cards of one color and putting them in the box at once. This method was discouraged as much as possible. It is a poor arrangement, we found, to have all the cards piled on the table, since it confuses the young child and gives the brighter child an unfair advantage. It would be better, as in the form card sorting experiment, to give the child a small number of cards to hold in its hand and to insist that the color card on the top of the pack be placed first.

Results.—Two-year-old children were not tested. The age scores are 26.3 at three years, 48.8 at four years, 64.9 at five years, and 79.7 at six years.

Discussion.—Success in this test is not altogether dependent on the speed of muscular coördination. Some children hesitated a long time before placing a card, and made errors which they sometimes corrected spontaneously and sometimes recognized only when the experimenter took the wrong card out of the box in order to prevent confusion. The material could be used advantageously for a practice experiment.

Association and Language

Of equal importance with the rapid development of motor control is the young child's progress in the mastery of oral language and in the formation of language associations. This progress is shown in the ability to recognize and understand and to reproduce sounds. For studying the formation of these associations the materials were a color naming, a picture vocabulary, a picture genus, and a speech test. The results for the first three of these are given in Table VI.

Color Naming

A test of the strength of the association is to be found in the ability to recall the name of a familiar color, even when fatigue begins to operate.

For this test the upper half of the Woodworth and Wells[150] color naming blank is used, a sample and fifty small squares of red, green, yellow, blue, and black. The child is shown the five sample squares, the rest of the sheet being covered, and the experimenter says, "What is the name of this color? This—? This—? This—" [pointing to each in turn]?

If the child knows the fundamental colors, the test is started immediately. If the child hesitates more than five seconds at any color or calls it by a wrong name, the experimenter tells the child the name and has the child repeat it. The row of colors is taught in this manner until the child can make one perfect recitation or until ten practice trials have been given. The children who do not know the colors by this time are usually too tired and bored to continue. To these children further practice trials are given later until the standard of one perfect recitation is achieved, or until it is evident that further time would have to elapse for the child to reach the necessary stage of development.

The test is given as follows: The experimenter says, "Now you name each of these colors and point to them as you go." The experimenter starts the watch as the child points to the first color. The experimenter records the number of errors made on each color. If the child hesitates more than five seconds, or calls a color by the wrong name, the right name is supplied and the child made to repeat it. The time for the naming of fifty colors is recorded and observations made in regard to the child's manner of performing the test.

Observational Notes.—Observation of the children while they are naming the rows of colors supports the view that it is really a great effort to abstract from the many confusing color stimuli and find the right name. Almost all the children wiggled and twisted and stuck out their tongues. They paused at the end of the line and took a long breath and seemed to have great difficulty in getting the right start on the new line; the speed slackened and the number of errors or slips of the tongue increased markedly as the test went on and the children lost their places if they did not point to each block of color.

Results.—Efficiency in performing this test obviously depends on ability to name the colors. Nine of forty-eight children never succeeded in learning the names of the colors sufficiently to take the test. Two-year-old children were not tested. The time required for naming fifty colors averaged 159.7 seconds at three years, 142.1 seconds at four years, 92.4 seconds at five years, and 92.1 seconds at six years.

Discussion.—Color names, like number names, are not a permanent acquisition at these ages. Slight fatigue or distraction results in such confusion that the association is broken down and the name is gone. Since the speed with which the names of colors can be given tests the strength of the association, this seems to be an excellent test for children who have learned the names of the colors.

Picture Vocabulary

Another measure of the strength of certain associative bonds is the ability to recall the names of familiar objects. This task occurs in all the forms of the Stanford-Binet scale and has been elaborated by Descoeudres.[32] Our experiment was made with pictures.

Picture material suitable for use with American children was found in the catalog of a mail order house. The fifty pictures, which were black and white and of rather uniform size, were pasted on index cards 3 by 5 inches. The objects represented were as follows:

1. Gun
2. Spectacles
3. Wagon
4. Hammock
5. Rowboat
6. Roller skates
7. Slide
8. Woman's sweater
9. Window awning
10. Scissors
11. Knife
12. Electric coffee percolator
13. Electric iron
14. Sideboard
15. Bureau
16. Table
17. Typewriter
18. Gloves
19. Flag
20. Child's underwaist
21. Garden tools
22. Bedroom slipper
23. Automobile
24. Rubber shoe
25. Suitcase
26. Oil stove
27. Steamer trunk
28. Man's hat
29. Man's shirt
30. Man's collar
31. Man's tie
32. Trousers
33. Cap
34. Sewing machine
35. Blankets
36. Safety pins
37. Spool of thread
38. Fountain pen
39. Woman's collar
40. Violin
41. Woman's hat
42. Kitchen range
43. Child's shoe
44. Bathtub
45. Wheel
46. Thimble
47. Sock
48. Umbrella
49. Electric fan
50. Telephone

The experimenter says, "See these cards? Of what is this a picture?" showing one card at a time and recording the response. The children are allowed as much time as they like. This time varies from about five to fifteen minutes for fifty cards. The answers are liberally scored in accordance with a list of correct answers.

Results.—The children enjoyed this test and named a great many of the pictures. The age scores increased from 19.2 pictures named at two years through 29.7 at three years, 38.0 at four years, and 44.0 at five years to 45.6 at six years.

Discussion.—This is of course only a test for names of common objects. An adequate picture-vocabulary test should include a larger number of objects and action pictures to bring out knowledge of verbs. It is also possible to construct pictures that test knowledge of adjectives and other parts of speech.

The study of vocabulary is being extended by Madorah Smith, research assistant in the Station, under the direction of the writers, by recording for each child the total number of words used during an entire morning at the laboratory and tracing the relation between the number of words to the sentence and the mental age of the child. The children are also tested with a sample vocabulary chosen by rule from Thorndike's list of 10,000 words and checked with thirty-four published studies of the vocabulary of individual children. The child's knowledge of the word is not determined from definitions, as in Terman's vocabulary test, but

FIG. 36. CLASSIFYING PICTURES.

is checked by means of pictures, objects, actions, and concrete situations. A number of the Descoeudres[32] tests of language are being used with results very comparable to those found by her for French children.

Picture Genus

Considerable insight into the development of the more complex associations can be gained through the use of tests requiring the child to classify various objects in terms of their species. An association test of this sort is the "subordinate-supraordinate" word test of Woodworth and Wells[150] and the classification test of Descoeudres.[32] In the latter, small pictures are to be sorted into similar groups as a test of judgment relatively independent of language. The following adaptation of the experiment has been used in this study, the task being the classification of examples of a larger class under the common term (Fig. 36).

Forty small pictures of common objects are pasted on cards 1½ by 1½ inches. The pictures, taken from test blanks in use for small children, can be grouped into eight classes as follows:

1. *Birds and things that fly:* beetle, butterfly, eagle, two song birds
2. *Things we keep in the kitchen:* broom, stove, bucket, teakettle, pitcher
3. *Playthings:* tricycle, hobby horse, drum, kite, teddy bear
4. *Fruit:* apple, grapes, pineapple, pear, banana
5. *People:* old man, Indian, young man, boy, soldier
6. *Things that people wear:* high hat, shoes, boots, coat, socks
7. *Animals:* rabbit, cow, squirrel, bear, horse
8. *Things that we plant:* four kinds of trees and a flower

Each of eight small boxes is marked with a picture identical with the first listed in each group. The experimenter says, "See here are a lot of little pictures. We want to put them in these boxes. We want to put all the birds and things that fly in this box. See, here is a bee [picking up this card]. We will put it in this box where the things that fly belong. Here is a broom [picking up card]. We will put it where the things that belong in the kitchen are to be put. [And so on through tricycle, apple, old man, hat, rabbit, and tree.] Now you go ahead and put all the little pictures in their right boxes."

The child is allowed to take its own time until it has placed all the cards. The score is the number of cards correctly classified.

Observational Notes.—Some of the drawings did not immediately suggest the object to the child's mind. Not all the classes are mutually exclusive and some pictures could quite logically be placed in more than one box, as for example the kite, which, though a plaything, certainly flies.

Results.—The age scores increased from 7.0 pictures placed at two years, 10.5 at three years, through 32.5 at four years to 33.2 at five years, and 37.6 at six years. The fact that there is little increase after four years shows that the material is applicable principally for use with very young children.

Discussion.—The test is probably too long to permit the very young child to keep the task in mind. Consequently there is a tendency after a while to pile all the cards in one box. The use of a time limit would give a better chance for the bright child to score. An extra set of eight sample cards different from the test cards should also be used to prevent the possibility of the child's thinking the test card must exactly match the sample cards. With these modifications the test should prove very useful when it is desired to study the development of logical reasoning without the complication of the verbal factor.

Speech

One of the essential examinations in the psychology of child development, particularly with young children, is that for normal speech development and for speech peculiarities or handicaps. If there are no speech defects, it is equally important to have a definite record of the child's speech characteristics.

There are two methods of setting up a test for speech diagnosis in the case of young children. The first method, saying the word after the examiner as he pronounces it, brings in the opportunity for imitation, which, with young children especially, is a large factor. Sounds usually articulated wrongly may be correctly given if careful attention is paid to the examiner's articulation. This is especially true of words that have little thought content or few associations for the child who then performs a mechanical exercise. The second method, arranging a situation so that the child produces the test word spontaneously, is much better adapted to work with little children since the child's natural manner of speech is secured.

Speech Test. 1

A picture test * that elicits spontaneous speech from the child has been devised and applied by Helene Blattner of the University Department of Speech, in coöperation with the writers.

Each of a series of 110 pictures portrays an object or suggests an action leading the child to pronounce the word desired. Standardized questions to be used with the pictures are printed on small cards numbered to correspond to their respective pictures. The test words are within the everyday experience of the normal child. Children greatly enjoy looking at the pictures and readily pronounce the desired words without becoming aware of the object of the test.

The pictures are presented to the child, one after the other, with the corresponding questions, such as, "What does the little boy have in his hand?" "What is he doing?" Occasionally, if the child does not answer with the desired word, the examiner initiates the articulation of the word or pronounces it. The examiner checks any defective sound as the child pronounces the test word and writes on the blanks the sounds as mispronounced, for example, "tat" for "cat."

The sounds and words tested are:

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* A report of the use of this test is given in an unpublished master's thesis on file in the State University of Iowa.

Consonants

1.	*h–*	hands
2.	*wh–*	wheel
3.	*w–*	window
4.	*p–*	pie
5.	*–p–*	paper
6.	*–pr–*	apron
7.	*pl–*	playing
8.	*b–*	boy
9.	*–b–*	baby
10.	*–b*	tub
11.	*bl–*	blocks
12.	*br–*	bread
13.	*m–*	man
14.	*–m–*	lemon
15.	*–m*	room and broom
16.	*t–*	table
17.	*–t–*	eating
18.	*–t*	boat
19.	*tr–*	tree
20.	*tw–*	twinkle and twist
21.	*d–*	doll
22.	*–d–*	riding
23.	*–d*	bed
24.	*dr–*	dress
25.	*n–*	nuts
26.	*–n–*	running
27.	*–n*	can
28.	*l–*	lamp
29.	*–l–*	collar
30.	*–l*	bell
31.	*r–*	raining
32.	*–r–*	barrel
33.	*–r*	flower
34.	*–r–*	(glide) corn
35.	*k–*	cat
36.	*–k–*	barking
37.	*–k*	cake and book
38.	*cl–*	clock
39.	*cr–*	creeping or crawling
40.	*–nk*	drink
41.	*g–*	girl
42.	*–g–*	digging
43.	*–g*	dog
44.	*gl–*	glasses
45.	*gr–*	grasses
46.	*–ng*	ring
47.	*–ng–*	singing and finger
48.	*f–*	fork
49.	*–f–*	laughing and coffee
50.	*–f*	knife
51.	*fl–*	flag
52.	*fr–*	frowning and frying
53.	*v–*	valentine and violin
54.	*–v–*	shaving
55.	*–v*	stove
56.	*th–*	(surd) thumb
57.	*–th–*	" something
58.	*–th*	" teeth
59.	*thr–*	thread
60.	*th–*	(sonant) there
61.	*–th–*	" father, mother, feather
62.	*–th*	(sonant) with
63.	*s–*	soap
64.	*–s–*	basket
65.	*–s*	house
66.	*sp–*	spoon
67.	*st–*	stick
68.	*sk–*	school
69.	*sl–*	sled
70.	*spl–*	splinter and splash
71.	*spr–*	sprinkle and spread
72.	*str–*	strawberries

CONSONANTS—*Continued*

73.	*sw–*	swimming and swing
74.	*sm–*	smelling
75.	*sn–*	snow
76.	*sq–*	squirrel
77.	*z–*	zigzag
78.	*–z–*	scissors
79.	*–z*	nose
80.	*sh–*	shoe
81.	*–sh–*	washing
82.	*–sh*	brush
83.	*shr–*	shrink or shrunk
84.	*–zh–*	measure
85.	*ch–*	chair
86.	*–ch–*	pitcher
87.	*–ch*	watch
88.	*j–*	jump
89.	*–j–*	engine and angel
90.	*–j*	orange
91.	*y–*	yes and yellow
92.	*–x*	box
93.	*qu–*	queen and quack

Vowels

94.	*oo* (1)	spoon
95.	*oo* (2)	book
96.	*o–e*	boat
97.	*–aw–*	strawberries
98.	*–o–*	clock
99.	*ee*	eating
100.	*–i–*	stick
101.	*a–e*	table
102.	*–e–*	bed
103.	*–a–*	glasses
104.	*a–*(r)	arm
105.	*–u–*	brush
106.	*–ur*	collar
107.	*–ie*	pie
108.	*–ou–*	house
109.	*–oi*	boy
110.	*u–i*	few

Results.—The results of the application of the test not only to preschool children, but also to school children, show that it provides a reliable summary of defective sounds as to number, position in the word, and type of articulation. None of the younger children was found to be free from slight defects of speech, mostly infantile lisps (baby talk) and peculiarities of expression, often grammatical errors. A considerable number showed traces of infantile stutter, that hesitation and repetition of consonants characteristic of the speech of a child who still shows awkwardness in using the vocal organs and feels the urge to express many new ideas in a limited vocabulary. This sort of defect is still at the pure habit stage and is subject to easy correction. Experiments are now being made with plays and singing games which will provide remedial exercises for these defects.

Discussion.—While the test is in no sense an intelligence test, and indeed every effort has been made to eliminate any advantage due to superior knowledge or experience, it furnishes, nevertheless, like the picture vocabulary test, a certain index to the experience of the child. Frequently the child expresses emotions of pleasure, envy, or amusement, often in just the inflection with which it pronounces the test word. If the examiner is to do the remedial work, such clues are of interest and value. For the children who have no outstanding defects, the test furnishes a satisfactory basis for specific training later in reading, elementary dramatics, and speaking before a group.

Speech Test. 2

An object test, as yet unpublished, for the speech of young children has been developed by Sarah T. Barrows, assistant professor in the Department of Speech of the University, and applied to the preschool children in coöperation with the writers.

The child is presented with a box and told: "Look inside and see the nice things I have for you to play with." As the child unwraps the toys the examiner makes notes on the child's spontaneous exclamations and joins in playing with the toys, leading the conversation in such a way as to bring out the sounds it is desired to study. A collection of toys is being standardized which will furnish a test of all the sounds in actual conversational use. Each one of these toys may be put into a situation which will call forth verbs and adjectives containing the desired sounds. The by-products are often the most useful. The toy to be presented depends on the age or known interests of the child. In the list the toy named at the left is designed to elicit the words at the right and the sounds indicated by the italicized letters.

TRAIN	*tr*ain, en*g*ine, *wh*eel, *c*ar, *y*e*ll*ow, smo*k*esta*ck*, *wh*istle, *gr*een, be*ll*, *ch*oo, *t*oo*t*, di*ng*-do*ng*, *s-s-s*.
RABBIT	*r*abbit, mou*th*, *wh*ite, *c*a*rr*ot, ear*s*, eye*s*, *gr*een, eat*ing*, *thr*ee rabbit*s*.
STOVE	*st*o*v*e, b*l*a*ck*, *k*ett*l*e, hand*l*e, *l*id, *c*o*v*er, *sm*o*k*e, *c*oo*k*, ba*k*e, o*v*en, *fr*y.
JUMPING JACK	*j*um*p*i*ng* *j*a*ck*, *l*e*g*s, *gr*een, *r*ed, *y*e*ll*o*w*, *sm*i*l*e, *sp*ot*s*, *wh*ite, *squ*ee*z*e, *s*ommer*s*ault, *str*i*ng*, *l*adder, nai*l*.
TABLE UTENSILS ...	kni*v*es, for*ks*, spoo*ns*.
TURKEY	tur*k*ey, *r*ed, *g*obb*l*e.
LAMB	*l*amb, or *sh*eep, *wh*ite, *r*ed, *gr*een, b*l*a*ck*, mou*th*, *r*ibbon, woo*l*, *baa*.
PIG	*pig*, *t*ai*l*, mou*th*, sitt*ing*, *l*oo*k*i*ng*, eye*s*, ear*s*, ba*ck*.
BUS	bu*s*, *wh*eel*s*, *w*ind*ows*, *g*oi*ng*, seat*s*, hon*k*-ho*nk*.
DUCK	du*ck*, *c*orn, eat*ing*, tal*k*i*ng*, runni*ng*, *str*i*ng*, *y*e*ll*ow, *r*ed, mou*th*, ne*ck*, ba*ck*, *quack*-*quack*.
TEA SET	tea *s*et, *pl*a*t*e, *c*u*p*, *c*offee po*t*, f*l*ower, *r*ed, *gr*een, hand*l*e, pou*ring*, eat*ing*, d*r*in*k*i*ng*, *c*a*k*e, *s*u*g*ar, sand*wich*, ice *cr*eam, *j*elly, *pl*ease, *th*ank you, bir*th*day party.
CHRISTMAS TREE....	*Christmas* *tr*ee, *gr*een, *r*ed, *S*anta *Cl*au*s*.
DOG	do*g*, eye*s*, b*ow*-*w*o*w*.
CAT	*c*a*t*, *k*itten, *r*ed, *r*ibbon, play*ing*, *s*itt*ing*, *wh*is*k*ers, mou*th*.
BEAR	b*ear*, b*r*o*wn*, bites, *st*and*ing*, mou*th*.
HEN	he*n*, *ch*i*ck*en, *cl*u*ck*, nest, *s*it, *eggs*.
ROOSTER	*r*oo*s*ter, *r*ed, *gr*een, *cr*o*w*, *c*o*ck*-a-doo*dl*e-doo.
UMBRELLA	umb*r*e*ll*a, *gr*een, *fl*ower*s*, *st*i*cks*, *r*ain, *s*un*sh*ine.

Discussion.—The result of this test will furnish information as to the amount and kind of mispronunciation to be expected from preschool children who have not yet perfected the speech mechanism and suggest remedial exercises disguised as games. One such game which can be used for diagnosis as well as for speech correction consists in having the child play "party" with a miniature tea set. The examiner says, "Please give me some coffee," and when the child has finished pouring a cup says, "What was it you gave me?" The child is thus stimulated to repeat the word coffee in accordance with the correct model just given by the examiner. In this way a child will play for a long time unconsciously receiving a drill on difficult sounds.

CHAPTER VI

MENTAL DEVELOPMENT: EXPERIMENTS IN ÆSTHETICS: RHYTHM, DESIGN AND PROPORTION

INVESTIGATIONS in æsthetic development have been confined to a few studies of color or picture preferences in school children. Other fields in art and music are comparatively untouched. We have made some preliminary experiments in musical rhythm, visual design, and visual proportion.

Rhythm

One of the first things one notices in observing the play of little children is their lack of a sense of rhythm in marching to music. Few children of this age seem able to mark time with the feet, or to clap hands in time to the music.

Keeping Time

During free play periods the children included in this study were observed to react to music with spontaneous movements of various kinds. Some clapped the hands together very rapidly, some swung the arms, or jumped about or took a few skipping steps, or ran. During the group exercises the children always entered with enthusiasm into a game of "playing orchestra," in which they clapped or rubbed blocks together while the phonograph was playing a lively march. An experiment was planned in which this situation could be reproduced as far as possible and a permanent record could be made of the status of the child in the development of the sense of rhythm as shown in this way (Fig. 37).

The experiment requires the coöperation of the child and three experimenters. One of the experimenters sits with the child in one of the examining rooms before a phonograph. The child holds in its hands two round blocks 2¼ inches in diameter by 1 inch thick, faced on one side with copper. Flexible wires attached to this copper lead through the wall to a couple of dry cells and the recording marker in an adjoining room.

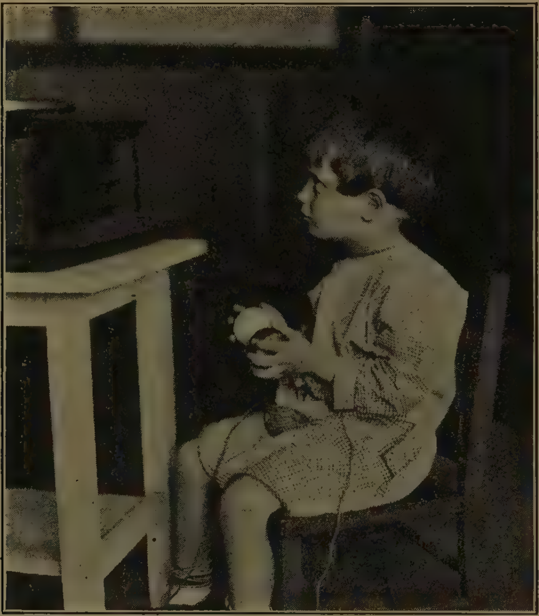

FIG. 37. TESTING THE DEVELOPMENT OF THE SENSE OF RHYTHM.

The experimenter says, "You remember the game we play, clapping blocks together in time to music? Well, we are going to play it in here now. Here are your blocks. You hold them this way." The experimenter gives them to the child, so that its fingers clasp the circumference, copper-side in, and starts the machine playing a march, the record turning at the rate of one revolution to the second. The experimenter continues, "Now listen to the music and let's beat time this way," holding the child's hands and helping it clap the blocks together four times. The experimenter then says, "Now you keep on doing it yourself until I tell you it is time to stop," looking attentively at the phonograph and offering no further suggestions unless the attention of the child wanders too much, or conversation is attempted, in which case the experimenter encourages the child to go on with the clapping.

As the child claps the blocks together, trying to keep time to the music, contact is made and the marker moves on the smoked surface of a kymograph. A time record is made simultaneously by a Jaquet chronometer beating fifths of a second. The child sees nothing of the recording apparatus, which is operated by a second experimenter.

As it is impossible to judge from the child's record alone with what fidelity it has followed the rhythm of the music, it is necessary to secure a standard of comparison. Accordingly, a third experimenter, with a good sense of rhythm, sits in another room, beyond the child's range of hearing. With a pair of blocks like the child's, this experimenter, who is making the standard record, also begins to beat time as soon as the music starts. The kymograph marker for this standard record is directly underneath that for the child, and as the two records are taken simultaneously it is at once apparent whether the child's beats and the intervals between beats are coincident with those of the standard. The experimenter who is operating the apparatus starts the kymograph after the first four preliminary beats and stops the kymograph after 45 seconds, giving the signal to the others to stop. After each observation the experimenter who has worked with the child makes notes on the child's performance.

Type Cases.—The following extracts taken from the notes of the examiner who sat with the child illustrate the different degrees of development in perception of rhythm.

M.H.: Really no sense of rhythm. Experimenter's early taps carried over by her for a short time, but just rapid taps afterwards.

T.C.: Poor rhythm, always too fast or too slow, mostly fast; makes a number of small quick taps in between slower ones. Attention and concentration good. Merely not developed in this function.

H.B.: Very poor rhythm. Probably did not beat the major beat more than a few times. Taps simply from inner compulsion.

R.W.H.: Really has good sense of rhythm, but is erratic. Stops for a considerable period every once in a while. Looks about room and is so inattentive that he loses rhythm.

C.C.K.: Good sense of rhythm in general, but doesn't keep it up consistently as attention wanders, looks around room, forgets to tap, holding blocks together, comes back to it again.

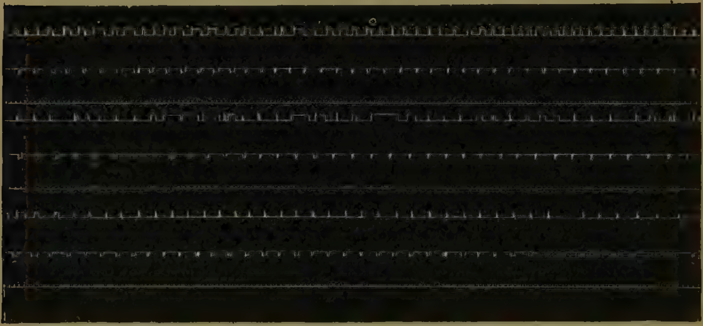

FIG. 38. RECORD OF RHYTHM TESTS OF THREE CHILDREN.

Observational Notes.—The children with a poor sense of rhythm were often observed to be beating time correctly for a few measures after the experimenter had started them off well, but then lagged or speeded up, maintaining a characteristic rhythm of their own. Some of the most intelligent and generally mature of the children were among this group with poor rhythm. In several cases excellent concentration and attention accompanied markedly poor rhythm, though in others the lack of a sense of rhythm naturally meant loss of interest in the performance and consequent inattention.

Results.—A study of the notes and of the kymograph records (Fig. 38) shows that the children shade off from those with rhythm relatively undeveloped to those with really good development, using the accenting of the major beat as the criterion. Figure 38 represents three observation periods. The lowest line, the ninth, and the other finely marked lines, the sixth and the third, are the marks of the chronometer beating seconds. The second, fifth, and eighth lines are those of the experimenter who was making the standard record. The first, fourth, and seventh lines are those of three children of whom the last shows the best development of the sense of rhythm. A good sense of rhythm is by no means limited to older children, two of the best records being made by children only three years of age. Some of the children with a well developed sense of rhythm hit not only the major beats but also the minor ones, tapping rapidly until the next major beat. A good many of the records show that good rhythm may lapse for a number of measures while the child is inattentive, but may be recovered. With one of the children the process seemed to be sufficiently automatic so that distraction did not affect his performance to any extent.

Discussion.—Only preliminary observations were made in this experiment, the technic not being as yet sufficiently standardized to give definite quantitative results. The method seems promising as a means of studying the development of rhythm and is particularly applicable for the preschool ages, as it does not require verbal or written response and makes little demand on more complex abilities, such as judgment.

Design

An experiment to determine children's conception of rhythm and symmetry in the visual field was carried on under our direction by Ruth Washburn, research assistant in the Iowa Child Welfare Research Station. The element of design is necessarily involved in any experiment of the kind. Since children are impulsive in their judgments and have difficulty in introspecting, the experiment called for performance rather than for the giving of judgments (Fig. 39).

Designing Chains

The material consists of wooden kindergarten beads of three shapes, round, square, and cylindrical, and six clear colors, red, orange, yellow, green, blue, and purple. These beads are large enough to be easily handled even by very little children. Shoe strings are used for stringing the beads. The fact that one end is stiff makes it very easy to run the string through the large hole in the bead. The element of manipulation is thus reduced to a minimum. The experiment is divided into three parts. Each child works with the examiner alone on each part of the experiment.

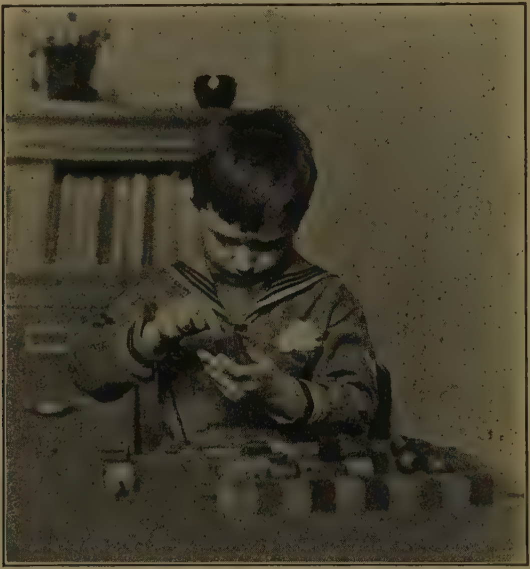

FIG. 39. COPYING A COLOR DESIGN WITH BEADS.

Seventy-two beads are placed in a frame in random arrangement on a low table before the child. The experimenter then says, "I want you to make me a pretty necklace or chain with these beads. I don't care what beads you put on as long as you make it what you think is pretty." The shape and color of each bead is recorded in the order in which it is strung. The chains are not scored in any formal way. Any plan which is carried out consecutively through a whole chain is considered successful, however simple the unit. Thus a chain consisting of sixteen round beads of varying colors, with the units consisting of one bead of one form and the color so varied as not to make any definite color units, is considered successful, as it involves a more or less rhythmic repetition and persistence in one plan.

Observational Notes.—The majority of these young children strung the beads without any plan of any kind, their chief desire being to fill up the string as quickly as possible. The only plan that they exhibited was an effort not to run two beads of the same color next to each other. A few children made chains that showed the beginnings of a plan, a unit repeated several times.

Results.—This experiment was continued through the fourth grade with the result that of 123 children only four showed a desire for symmetrical arrangement.

Copying Chains

The next experiment consists of an attempt to discover at what age children can copy chains of beads and whether chains in orderly rhythmic arrangements are easier to copy than a heterogeneous arrangement without any definite unit of composition.

A chain of nine beads was prepared for copying, one with rhythmic units and a second lacking the element of design or order. For each chain the child is given eighteen beads, one of each of the six colors, and sufficient beads to duplicate the particular model that the child is to copy. The rhythmic chain was shown first and then the unrhythmic. The instructions are simply, "Make one just like that." Each bead strung by the child is recorded by shape and color. Each bead of the correct shape and color is counted 1, and if it also corresponds in position to a bead on the copy it scores another 1, making a possible total of eighteen for each chain of nine beads.

Observational Notes.—The children did not think it difficult to copy the chain, but it was evident that practically none of them grasped the idea of a unit that was being repeated. Many children simply put the chain they were copying beside the model and added bead for bead. Many of the errors made by the older children were due to carelessness in losing the place or to impatience rather than to inability to perform the task.

Results.—As shown in Table VI, the age averages for the rhythmical chain are 0.5 points at two years, 7.8 at three years, 12.6 at four years, 17.1 at five years, and 16.1 at six years. The results for the unrhythmical chain are very similar. Such differences as exist show that it is, if anything, easier to follow the unrhythmical than the rhythmical chain.

Copying Chains from Memory

After watching the performance of the subjects in the higher age groups on the first series of chains, it was believed that a more interesting test could be devised if the model chain was not left where the child could see it for the whole time of the test, but was shown only for a few seconds and then withdrawn. Here again the desire was to discover whether it was easier for subjects to reproduce a chain in which there was a unit of composition, or one in which there was not such a unit.

A new rhythmical chain is presented to the child with the directions, "I am going to show you a chain of beads. I am going to show it to you for only ten seconds and then I am going to take it away again. Be sure to look at it carefully, because ten seconds is a very short time, and after I take it away I am going to ask you to make one just like it." A new rhythmical chain is then presented in the same manner.

Observational Notes.—It was evident from the stringing of the first bead whether or not the performance would be successful, as the child's memory of the chain seemed to be either vivid or impotent. If a child got a wrong start it was held up by the lack of beads of the color it had started with, as the frame contained only enough beads to make a complete chain like the one shown. Occasionally the child then worked out the correct chain with the beads at its disposal, if it had some memory of the necessary form, color, and design. But the more usual reaction was to say, "I can't make it because you haven't given me the right beads." The experimenter then replied, "Make it as much like mine as you can," and the child worked along, substituting the form and color nearest to its own memory.

Results.—With the same system of scoring, the age scores for the rhythmical memory chain as shown in Table VI were 5.6 points at three years, 14.3 at four years, 16.5 at five years, and 16.3 at six years. The unrhythmical chain was again somewhat better done than the one with design, probably because the former was felt to be difficult and therefore compelled better attention.

Discussion.—With both the chain copied and that made from memory a higher score was obtained for fidelity to color and form of the model than for design. The memory chain did not yield a consistently lower score, as might have been expected. The results of these experiments show that the ability to grasp and to appreciate design or symmetry develops considerably later than might have been expected, perhaps not until after the first school years. Great development in the ability to reproduce an arrangement of colors and forms takes place, however, even before the rise of appreciation of design.

Proportion

The development of children's concept of proportion was the subject of a preliminary investigation by Ruth Washburn, research assistant in the Iowa Child Welfare Research Station, under the direction of the writers, with material that was familiar and could be judged by the results of a performance rather than by the statement of judgments and preferences.

Completing Paper Houses

The appeal that building in miniature makes to children was utilized in devising an experiment to test their conception of proportion.

A model of a house has been made with detachable parts in various sizes for adjustment by the children. The body of the house, without roof, door, windows, or chimneys, is made of white cardboard in the shape of a rectangle with a base 17 inches in the golden proportion; that is, the height of the rectangle is to the breadth as the breadth is to the sum of the height and breadth. Clapboard lines across the front of the house, a gray stone foundation, and a white doorstep add realism. The parts to be placed by the child include four green roofs, four sets of windows, five in the set, four green doors, and four sets of chimneys, two in the set. One of the four is always constructed according to the theoretically correct proportions as outlined in Robinson's[116] *Architectural Composition.* The others are always larger or smaller. The cardboard representing the side of the house is placed on the table and the child directed to "put on the roof that you think looks best on the house." Next a door, then windows, and then two chimneys are placed.

Results.—Quantitative results were not obtained. The children liked the larger roof, door, and chimneys and the smaller windows. The majority did not prefer the roof, door, chimneys, and windows that represented the theoretically correct proportions. A class of adult art students, on the other hand, did not choose the extreme sizes. There was evidence to show that children are more likely to consider parts or details of a whole separately in the fact that the children made very few changes after their first placement of a part, while the members of the adult control group made most of their changes after they had seen the house as a whole. The older children showed some desire for balance, for if they used windows of different sizes they greatly preferred the smaller windows for the second story, making the house look heavy at the bottom, and did not use windows of different sizes on the two sides of the house.

Discussion.—This experiment, like the one on design, shows the relatively late development of æsthetic preferences that are characteristic of the adult. These experiments are of interest as examples of the application of objective methods to a field that has been largely speculative because of the difficulty of devising experimental technic for young subjects. The traditional kindergarten has undoubtedly overestimated the degree to which the sense of rhythm, symmetry, and design is developed in young children of the preschool age. On the other hand, the kindergartens have materially aided in the development of these abilities of the child entering school.

CHAPTER VII

MENTAL DEVELOPMENT: EXPERIMENTS IN CONCEPTS OF WEIGHT, NUMBER, AND TIME

THE first part of a child's life is spent in a world of sensations and perceptions. Gradually there are built up general ideas, or concepts. It was in order to study the development of some of the fundamental concepts of weight, number, and time that we undertook preliminary experiments, the results of which are shown in Table VI.

Weight

In giving the Stanford-Binet weight test (Year V, Test 1), it was noted that this seemed less a test of ability to discriminate the weights, which were, after all, very different, than of ability to understand the meaning of "heavy" and "light" (Fig. 40).

Estimating Weights

An experiment with boxes filled with shot was devised to teach the difference and to analyze the development of the weight concept. The method was somewhat similar to that used by Town.[141]

The material consists of a small balance, eight pasteboard pill boxes, and a quantity of shot. Two of the boxes are empty. The others are filled with cotton and shot to weigh 3 gm., 6 gm., 9 gm., 12 gm., 15 gm., and 24 gm. respectively. The two empty boxes are shown the child, and one is placed in each of the child's hands. The experimenter says, "You feel them, they feel just alike. Now let's open one and put something in it. [Pours in shot.] You feel them now. They feel different, don't they?

This one [filled] makes your hand go down. It's heavy, heavier than this one. This one makes your hand go up. It's light, lighter than the other one. Here's something like your hands. [Shows scales.] If you put the heavy box on this pan and the light one on this, the heavy one goes down and the light one goes up. Now we'll mix up the boxes and you tell me which is the heavier and then we'll put them on the pans and see if it really is the heavier." The experimenter puts one box in either hand of the child and says, "Give me the heavier one." When the child has indicated the heavier one, the experimenter takes the weights and places them on the scale pans, each on the pan directly opposite the hand that has held it. Usually the child prefers to put the weights on for itself. Three trials are given and the heavy weight is placed alternately in the right and left hand. If the child does not judge the heavier weight heavier on all three trials, the directions and practice are repeated. When the child seems to understand what is meant by heavy and what is meant by light, the test boxes are given in the following combinations, three trials on each with a check by the scales afterwards: (1) 3 gm. and 24 gm., (2) 3 gm. and 15 gm., (3) 3 gm. and

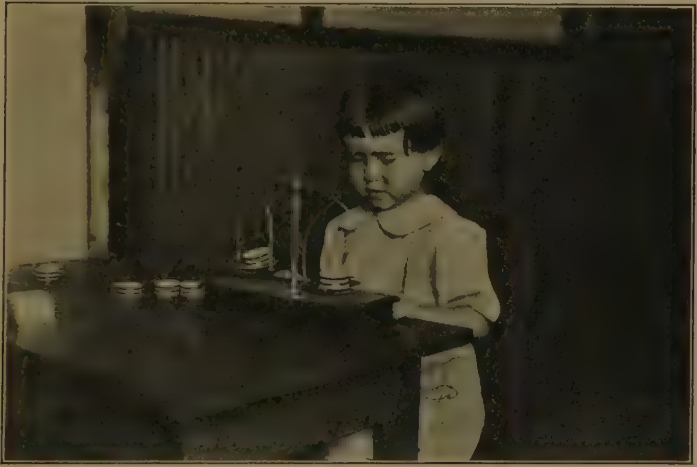

FIG. 40. "LIGHT" AND "HEAVY" ACQUIRE A MEANING.

12 gm., (4) 3 gm. and 9 gm., (5) 3 gm. and 6 gm. The test is scored by giving 1 point credit for each correct discrimination.

Observational Notes.—Very few of the children had ever used a balance. They enjoyed putting the weights on the scales, and the majority of them seemed really to understand that the scales told which weight was heavier. The others labored under various misapprehensions. Some seemed to think that one or the other pan was "the heavy one" and so always judged the weight on that particular pan as the heavier. Some could not understand why weights must be on both pans, since a pan obviously went down when something was put on it. The children were liable to forget which weight they had called heavy and had to be reminded if the check was to have any value. Some of the children who did not understand the scales were nevertheless able to make very accurate judgments.

Results.—All of the children succeeded in distinguishing 3 gm. and 24 gm. The younger children began showing confusion on 3 gm. and 15 gm. The discrimination of 3 gm. and 6 gm. offered a genuine difficulty to almost half of the children. The average score was 11.6 points for three years, 13.0 for four years, 13.5 for five years, and 14.3 for six years.

Discussion.—The age scores show that there was little development of the function after four years with the weights used and indicate that the test was too easy for the majority of the children. A revision of the test should use, at the beginning of the experiment, weights that are more nearly alike, and should include fewer comparisons, since the present series is rather fatiguing. Nevertheless, the fact that after the children had acquired the concept of weight they still showed confusion between similar weights shows that for children of the earlier ages this is really a test in discrimination.

Number

Few experiments have been made on the development of the number concept. Binet and those who have issued revisions of his scale have determined the ages at which four and thirteen objects can be counted. Several brief articles have appeared in child study magazines, but almost the only recent scientific work has been done by Decroly and Degand [28] and by Descoeudres.[32] In the preschool laboratory a series of simple experiments with number has been tried in order to determine how the child analyzes "much" and "many." The first three tests are given at one sitting, the remainder on another day.

Test 1

The first test is carried out as follows:

> The child sits at a table on which are placed two empty frames and a third frame containing thirty cylindrical sticks 2¼ inches by ¼ inch. The experimenter asks the child to "hide its eyes" and then places in a row in the center of the left-hand, the empty frame, the predetermined number of sticks. The white sticks on the green table are very striking. The directions are: "See this place with the sticks in it? Now you put as many in here [pointing to the empty frame] as there are in here [the frame with the test number of sticks in it]. Take them out of here [the frame full of sticks]." When the child has placed what it thinks to be the proper number of sticks it is again asked to hide its eyes and the directions are repeated after the experimenter has placed the next test number of sticks. This procedure is followed until all ten numbers have been tested in the following order:
>
> 3—6—4—9—1—10—2—5—7—8
>
> Record is kept of the number of sticks placed by the child and the general manner of performance. After the entire series the child is asked, "How can you tell when you have as many in here [empty] as you saw in here [sample]?" A score of 1 is given for each correct matching.

Observational Notes.—The children in general enjoyed the test (Fig. 41), although the younger ones found the long series of matchings rather wearisome toward the end. Not very many of the children could tell how they knew the number of sticks to put in their frame to match the experimenter's number. Some said they "just knew." Others said they "could see." A few said they counted, although even these did not always do so, but guessed at the larger numbers. Some children merely grasped a handful of sticks and put them in with no understanding of the task. Occasionally a child started out well, but then lost sight of the main task and began to play a game of its own, or kept on putting sticks into the frame, getting pleasure from this activity as an end in itself. The arrangement of the sample sticks in a row facilitated visual estimation, and some children were obviously comparing the sample row with the one they were making, adding or taking away a few sticks according to their notion of equality. With this method they occasionally made use of such expressions as

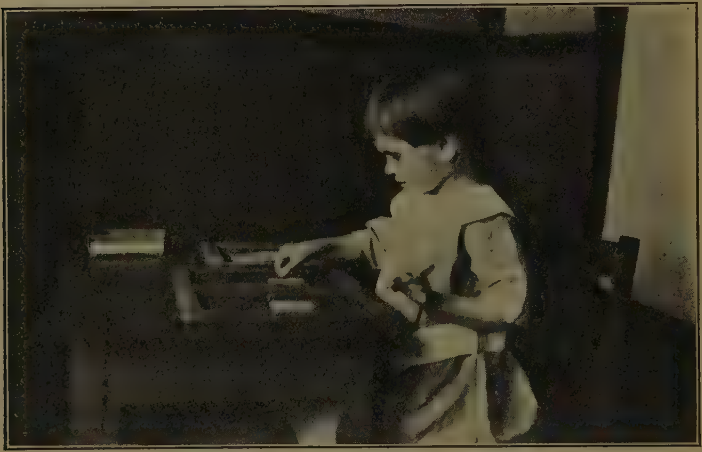

FIG. 41. MATCHING STICKS IS A TEST FOR NUMBER CONCEPT.

''not enough'' or ''too many.'' The more advanced children made use of counting, first counting the sample row and then their own. Sometimes this counting was oral, sometimes silent, with touching of the sticks to keep the place. Some children were very careful to check their numbers. The children who counted the smaller numbers often reverted to the method of estimation for a number larger than five. The single stick as a test number was regarded as a joke by some children. It seemed to puzzle others who were apparently confused by the direction: ''Put just as many in here as in there.'' Here our observations confirm those of other experimenters.

Results. As was to be expected, the smaller numbers were more accurately matched than the larger ones. The age scores were 1 at two years, 2.4 at three years, 4.7 at four years, 6.3 at five years, and 7.5 at six years.

Test 2

Immediately after the matching of sticks a counting test is given.

The child is asked, "How far can you count? Let's hear you count as far as you can." The time for the performance is taken and a record kept of the number of series the child gives. The score is the highest number correct without intervening error.

Observational Notes.—Some of the children had no idea of what counting meant or they knew only a few number names without knowledge of their order. Others could say a few numbers in order and then skipped to higher numbers.

Results.—The scores on this counting without objects were 1 point at two years, 3.4 at three years, 10.6 at four years, 23.7 at five years, and 25.3 at six years. It is evident from a comparison of records of the first two tests that children can occasionally match objects without actually being able to count. There is, moreover, an opportunity for chance success at matching.

Test 3

A third test given at this sitting is the counting of marbles.

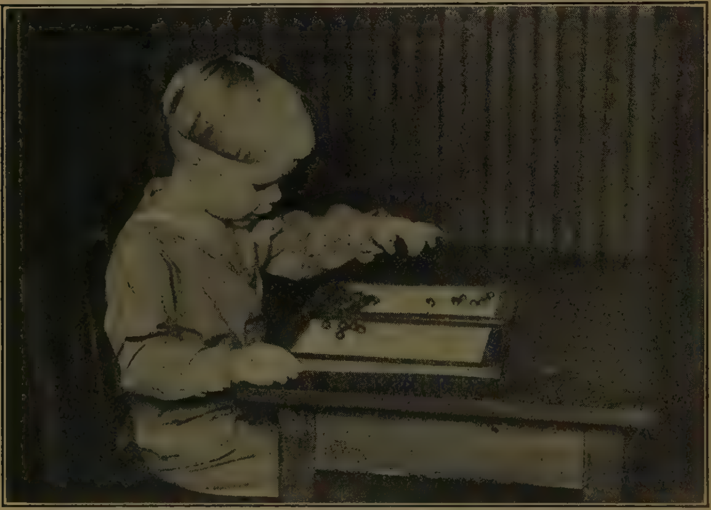

Fig. 42. COUNTING OBJECTS.

The child takes the marbles from one box and places them in another. The directions are: "Take these marbles out of this box, one at a time, and put them in here and count them as you put them in." Record is kept of what is said by the child and notes made of the number of marbles actually put in at each count.

Observational Notes.—Any such counting test was of special interest to the younger children who were just approaching the age of counting everything in the environment. The children liked to drop the marbles into the box (Fig. 42), but frequently this did not stimulate counting. Some children repeated a short number series over and over.

Results.—The average age score was in general lower than the score in Test 2. No score was made by the two-year-olds. The score was 2.1 points at three years, 9.2 at four years, 21.3 at five years, and 27.6 at six years. Counting with objects is more difficult than merely repeating the several numbers, though occasionally a child can count better under the stimulus of touching objects.

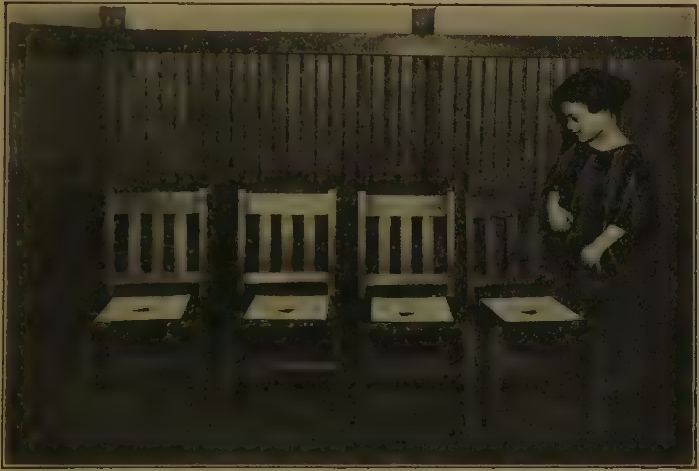

FIG. 43. SHARING AN "APPLE."

Test 4

The next experiment was devised to test the child's knowledge of fractional parts and its appreciation of the fact that an object can be divided among a number of people according to the size of the parts (Fig. 43).

The material consists of a red pasteboard circle, 4 inches in diameter, and four circles of the same size, one cut in two, one cut in three, one cut in four, and one cut in five pieces, pie-fashion. These may be numbered from 1 to 5. The circles, pieced together, are placed on the table before the child as follows: 1—3—5—4—2. The experimenter says: "Let's play that this is an apple for you [giving the child the whole circle]. Now, see! Here are some other apples already cut into pieces [showing the other circles]. Suppose you wanted to share an apple with me. You take the one that's already cut for two people. Take half yourself and give me half." After the child's response has been recorded and the pieces of the "apple" chosen have been put back into the row to prevent accidental success, the experimenter continues: "Suppose that Caroline were sitting on that chair over there [showing a third chair]. You get the apple that is cut for three people and give each of us a third." Appropriate directions are given for 4 and 5. A score of 1 is given for correct sharing of each of the four test apples.

Observational Notes.—The performance of distributing pieces of apple to children supposed to be sitting on the various chairs made a great appeal to all the children. The younger children did not seem at all worried if they had too few or too many pieces for the people who were to share. Some picked out pieces from two or three of the circles. Some went straight along the line using always the next circle in order. Some used the same circle (fourths or fifths) for each division. One child who was supposed to divide an apple for herself and four other persons chose the quartered apple and then, realizing that she herself had no piece, took one of the pieces from another circle for herself. Other children who also failed to understand the difference in the sizes of the parts obtained enough pieces to "go around" by choosing from various circles. One child whose manners were better than her number concept left on the table, for politeness, a piece of every apple she divided. There is, of course, considerable opportunity for chance success. Possibly a success should not be credited unless all preceding choices have been correct. This does not allow for learning, however, as in the case of one child who divided the fifths among four persons and was worried by the piece left over. On the following trial she deliberately chose this circle again and divided it correctly among five.

Results.—The age scores show that the younger children have little success, the average being less than 1 point at two and at three years. By four years the score is 1.2, by five years it is 2.4, and by six years 3.4.

All the divisions were correctly made by the majority of the junior primary children. The test is an interesting and convenient method for determining the development of young children in this aspect of appreciation of number.

Test 5

Another variation in the method of determining the development of the number concept was planned.

> The child is shown two bells of the type that rings when tapped on a button at the top. The experimenter says: "Let's play with these bells," demonstrates how the bell is used, and allows the child to play with it for a few minutes. The experimenter then continues: "You listen while I tap my bell and then you tap yours just as many times as I tapped mine. [The experimenter taps twice.] Now you tap yours just as many times as I did mine." The experimenter then places her bell in such a position that the child can not see her tap it and continues with a series of taps: three, six, four, nine, one, ten, two, five, seven, eight. A record is taken of the child's taps. The score is 1 for each number correctly tapped, with a maximum of 10.

Observational Notes.—The test worked out well. Very few of the children seemed to be just playing with the bell. Wild ringing was shown only in response to the higher numbers, which were plainly beyond the child's ability to count. The younger children did not comprehend the task, but merely tapped in imitation of the examiner. Usually they imitated one tap correctly, but often said for higher numbers that there were "too many." The junior primary children usually counted the examiner's and their own taps quite audibly. Some children realized that they had not tapped the right number of times, but could not better their performance on later numbers of the series.

Results.—The age scores showed 0.7 points at two years, 1.2 at three years, 3.6 at four years, 4.1 at five years, and 5.6 at six years. The test is more difficult than the matching of sticks because the visual clew is lacking and the auditory presentation requires very close attention. Children who were probably able to count beyond ten failed at lower numbers perhaps because of difficulty in attending for a sufficient length of time.

Test 6

Another test on the same number series was administered by having the child give the experimenter the required number of sticks.

Twenty-five sticks such as are used in Test 1 are piled within a wooden frame. The experimenter says to the child: "Give me three sticks." A record is made of the number of sticks given by the child and the direction repeated for six, four, nine, one, ten, two, five, seven, and eight. The score is 1 for each number correctly given.

Observational Notes.—The children who knew the meaning of the number words as applied to an actual number of objects reacted quickly. Some checked their own performance by oral counting. For the higher numbers they frequently grabbed a handful of sticks with an air of indicating that counting was hopeless.

Results.—The age scores were 1.3 points at two years, 1.3 at three years, 4.6 at four years, 7.0 at five years, and 7.9 at six years. These are higher than in the bell tapping, perhaps because the attention does not need to be so close. The test resembles the situations in real life, in which the child is required to bring a certain number of objects, as, for example, when it is asked to go down to the cellar and bring three potatoes.

Discussion.—The results of these experiments indicate that in the development of the number concept the child first becomes aware of the fact that people count, and begins to repeat number series it happens to hear. Soon this process is associated with touching of the objects counted. It learns certain number names in any order and applied to any number of objects. Mechanical learning of a series of greater or less length follows. The first part of the series is usually correct, although some children do not realize that one is the first number, and begin counting at two or three or four. The last part of a child's number series is often full of skips or gaps. For example, a child may say the numbers one to eight correctly and then eleven, fifteen, eighteen. It is noticeable that many children when asked how far they can count have no idea until they reach the end of the series. When the child has exhausted its own series it often invents fictitious names for numbers it knows must exist beyond, such as "eleventeen" or "twenty-ten." Some children having reached their limit go back and repeat part of the series as if they believed this to be the continuation. The learning of one to twenty is most difficult. Gradually the higher numbers are filled out, usually in groups of ten.

The ability to count objects develops at the same time with the learning of number names, but lags somewhat behind. At the early stages the child may not realize in counting a row of pennies that the end penny is to be counted first, but will just as readily begin with the second or third or put its finger between pennies. Or the child may say the serial numbers correctly, but does not realize that each number name belongs to a separate object or that, for example, four is a cumulative term meaning three and one. Thus a child will touch two objects and say one number, or will say two numbers for one object. This phenomenon may be due partly to difficulty in following with the eyes or to loss of count from lapse of attention, but is mostly dependent on an imperfect understanding of what counting really means.

A child's knowledge of number is not a fixed possession. Sometimes it can say more numbers than at other times. A child occasionally omits a number that it obviously knows, as for example the boy who counted to ten but omitted the number two. The number concept also depends on material and circumstances. One little girl could count four fingers, but labored under the delusion that the little finger was always the fourth. The performances of the same children in the various number experiments described are not on an equality. The child who can give ten sticks upon request can not reproduce ten taps upon the bell. Groups of sticks are, of course, more easily analyzed and matched than a long row. Descoeudres, who made experiments with a long series of number tests on the same children, also gives many examples of this lack of correlation. In view of this unevenness of development, it seems to be rather a hopeless task to decide at what age two is distinguished from three, or to assign a "number age" to a child. Further work on these problems will have to consist of the establishment of norms for certain definite processes.

Time

Many of the biographies of babies include incidental observations on the development of the concept of time. Binet made many contributions to the subject. Among the more elaborate analyses are those of the Sterns,[130] Decroly and Degand,[28] and Oakden and Sturt.[98]

Time Intervals

For our study a series of forty-seven questions was asked the children. These questions may be divided roughly into two classes, the first group of thirty-one dealing with short intervals, with clock time, and with the daily schedule of events, and the second group of sixteen dealing with longer intervals and with concepts of time such as season, and age-relationships.

GROUP A: SHORTER TIME INTERVALS

1. What day is today?
2. Is it morning or afternoon?
3. When does afternoon begin?
4. How long will you have to wait until tomorrow is here?
5. Does tomorrow come after or before yesterday?
6. How many hours are there in a day?
7. What meal do you have after you get up?
8. What meal do you have after you go home from school?
9. What meal do you have before you go to bed?
10. How do we tell time?
11. What time does the clock say now?
    [The examiner sets the clock at nine.]
12. What time does the clock say now?
    [The examiner sets the clock at two:thirty.]
13. What time does the clock say now?
    [The examiner sets the clock at five.]
14. What time is it now?
15. What time does your mother's clock at home say now?
16. What time is it in Cedar Rapids? [A nearby town.]
17. At what time do you get up?
18. At what time do you go to bed?
19. At what time do you have breakfast?
20. At what time do you have dinner?
21. At what time do you have supper?
22. *a.* Do you lie down after you drink your milk, or before?
    [For younger group of preschool children.]
    b. Do you have roll call before you lie down or after?
    [For older group of preschool children.]
    c. Do you drink your milk after recess or before?
    [For junior primary school children.]

23. How often does the nurse come?
24. What is the thing to do if you are getting ready for school and see that you may be late?
25. Do we have school on Saturday?
26. What do you do on Sunday?
27. Does Sunday come every week or every other week?
28. Which is longer, an hour or a minute?
29. Which is longer, a week or a day?
30. Which is longer, a year or a month?
31. How long do you think you have been in the room?
    [This question is asked when the child is about to leave the room after the interview.]

GROUP B: LONGER TIME INTERVALS

1. What month is this?
2. What day of the month is this?
3. What year is this?
4. Put these pictures in a row, first the picture of the youngest person and then the picture that shows a person who is a little older, and then the next older, and the next older, and the oldest at this end.
5. Where is the baby? The boy? The young man? The grown man? The old man?
6. Who is older, your grandmother or your mother?
7. How long will it be before you grow up to be a big man [woman]?
8. Your teacher is older than you are, isn't she? When you grow to be as old as your teacher is, will she still be just as old as she is now?
9. How old are you?
10. When is your birthday?
11. How long ago was your birthday?
12. When is it coming again?
13. How many times a year does Christmas come?
14. Is it summer or winter?
15. When is it colder, in winter or summer?
16. When do the leaves come out on the trees, in spring or fall?

Results.—The individual questions may be analyzed by noting the differences in the reactions of the younger and the junior primary children. The ages of the younger children at the time of the test ranged from twenty-eight to sixty months, those of the junior primary children from sixty-one to seventy-four months.

Twelve of the twenty children in the junior primary school knew the day of the week, but only one of twenty in the other two groups. The older children who had a more formal type of school work had, of course, more opportunity to learn the day than the younger ones, for whom the discussion of the day was merely an incident in the morning exercises. This probably represents an age difference as well. The month and the day of the month are learned later, usually in close association; the year comes last.

More than half of the children in the three groups knew whether it was morning or afternoon and about the same number understood tomorrow in reference to today and yesterday, but relatively few could tell how long it would take for tomorrow to arrive. This illustrates the fact that general understanding of broad time relationships precedes knowledge of the exact number of hours. Only six children of forty could tell the number of hours in a day.

The names of the three main meals and their orientation with reference to striking events in the day were known by the majority of the children. Almost an equal number knew the time of the clock for meal times and bed times. It is probable that this is mere rote memory.

Orientation of events in the daily schedule of the two younger groups was less good. These events were probably less striking to the child than the major functions of meals, bed, and so forth. Very few of the children could read the clock at the times set by the examiner. Children can often read certain settings of the hands that have a special meaning, such as bed time. They recognize the picture made by the hands. Later they locate other positions, probably identifying the hours first, then halves and quarters. If they are able to identify the numerals they can often report "The big hand is on—and the little hand near——."

The majority of the children were orientated with regard to special days of the week, but had little appreciation of annual holidays. Many could give their age and birthday by rote memory, but evidently they had no real understanding of the fact that birthdays arrive at certain regular intervals and that their ages increase by a year at a time.

The concept of a long number of years was poorly developed in these little children, as was shown by the picture arranging test. Five pictures, a baby, a child, a young man, a middle-aged man, and an old man were to be arranged in the order of increasing age. Although the children could identify the pictures and point to the old man, the baby, and so forth, they showed little understanding of the time relationships involved. Further experiments in time sense should include a check on the child's use of time words.

Summary of Results.—The age scores show a little success at three years, with an increase at each age thereafter. The percentage of correct answers in each group of tests and for the total of forty-seven was as follows:

PERCENTAGE OF CORRECT ANSWERS

Group	3-year-old Children	4-year-old Children	5-year-old Children	6-year-old Children
A	1.3	2.9	5.4	6.8
B	1.5	2.5	4.8	6.2
Total	1.4	2.8	5.3	6.6

Discussion.—At four, five, and six years the questions dealing with shorter intervals of time show a slightly higher percentage of correct answers than do those dealing with longer intervals. The difference is very small, however, and should only be regarded as a slight confirmation of the common observation that children appreciate shorter intervals of time sooner than long intervals.

CHAPTER VIII

MENTAL DEVELOPMENT: THE RELATION OF PRACTICE, SEX, AND SOME PHYSICAL TRAITS TO MENTAL TRAITS

THE data from the psychological examinations reported in the previous chapters may be analyzed to furnish information on some special aspects of mental development, such as the influence of repetition of a test after a considerable interval, sex differences in mental growth, and the interrelations among mental and physical functions as revealed by the method of total and partial correlations.

The Influence of Practice

A small group of children who had attended the preschool laboratory in 1921 to 1922 was again tested in 1922 to 1923 with the same fifteen mental tests. The average score on the second trial showed, of course, an improvement over the average score five to thirteen months earlier. The average on the first trial on any test was compared with a new norm worked out to correspond to the average chronological age of the group at that trial. The average on the second trial was similarly compared with a new norm for the later chronological age. On the first trial the average was below the norm in five tests and above in ten; on the second trial the average was below in two tests and above in thirteen. In other words, this group of children was superior to the average child at both ages. It will be noted that the children improved more from the first to the second trial than the corresponding difference in the norms. This may have been due to the fact that they were a superior group or that they had an advantage from previous practice. The results on such a small number of cases are not especially significant in themselves, but they illustrate the method of repeating the examination in order to get an insight into this phase of individual development through consecutive records.

Sex Differences

Since there are differences in physical growth even during the earliest years of childhood, it is not improbable that there may be differences in the ease with which boys and girls can perform certain intellectual and motor tasks. Accordingly, as the number of boys and girls included in the study was quite comparable, the data were compiled with a view to analyzing sex differences. The boys and girls studied at any particular age would have to be of about equal chronological age and general intelligence in order that a difference in the average score on any test might be attributed to actual differences in ability rather than to other factors, such as physical maturity or general mental development.

The boys of our study who were grouped as two years of age average 1.9 months older than the girls of the same age, but are 1.7 months lower in mental age, so there is a difference of 14.8 points in I.Q. in favor of the girls. The difference in chronological age between the boys and girls classed as three years is only 0.3 month and the difference in mental age only 0.1 month, so the difference in I.Q. is 0.6 in favor of the boys. The boys and girls classed as four years of age average the same number of months chronologically, but the girls are 3.4 mental months higher and 6.7 points higher in I.Q. The boys classed as five years of age average 1.7 months older than the girls. The mental age of the boys is 1.3 months higher, but their I.Q. is 1.9 points lower than that of the girls. The groups of boys

TABLE VII. — SEX DIFFERENCES IN MENTAL TRAITS AT 3 YEARS

TEST		BOYS		GIRLS	
		Number	Average	Number	Average
Stanford-Binet	Chronological age, months	22	36.0	18	36.3
	Mental age, months	22	40.5	18	40.6
	I. Q.	22	112.2	18	111.6
Detroit Kindergarten	Score	10	6.8	11	9.0
Card Sorting	Score	15	1.5	14	−1.8
Wallin Pegs					
Board A	Score	14	6.0	14	6.0
	Time, seconds	14	43.2	14	52.5
Board B	Score	14	2.4	14	2.1
	Time, seconds	4	32.8	3	33.3
Board C	Score	14	4.4	14	3.4
	Time, seconds	5	37.6	2	33.0
Board D	Score	14	4.8	14	2.9
	Time, seconds	7	71.0	1	60.0
Goddard Form Board	Failures	1		1	
	Time, seconds	13	59.9	15	90.0
	Errors	13	4.4	15	6.4
Mare and Foal	Failures	4		2	
	Time, seconds	6	278.5	6	343.8
	Errors	6	12.8	6	14.7
Montessori Cylinders					
Board A	Failures	2		3	
	Time, seconds	8	77.8	3	123.7
Board B	Failures	3		3	
	Time, seconds	7	90.3	3	68.7
Board C	Failures	9		6	
	Time, seconds	1	105.0	0	
Montessori Tower	Failures	7		6	
	Time, seconds	2	110.0	0	
Form Cancellation	Score	9	8.1	7	7.4
Porteus Maze					
Cross	Score	10	20.0	8	29.8
Diamond	Score	10	24.8	8	33.0
Star	Score	10	10.0	8	16.4
Three Hole	Score	18	20.1	16	20.1
Perforation	Score	12	17.8	12	19.7
Walking Board	Score	9	2.1	10	2.5

TABLE VII. — SEX DIFFERENCES IN MENTAL TRAITS AT 3 YEARS
Continued

Test		Boys		Girls	
		Number	Average	Number	Average
Montessori Frames					
Frame A	Score	7	1.4	9	2.7
Frame B	Score	7	4.1	9	3.8
Frame C	Score	7	0.9	9	8.1
Frame D	Score	4	0.0	6	3.0
Frame E	Score	4	1.8	6	6.5
Frame F	Score	4	2.8	6	5.3
Frame G	Score	4	0.0	6	0.0
Tracing Path	Score	9	54.9	9	52.1
Knox Cube	Score	13	.05	15	0.4
Adaptation Board	Score	13	1.3	15	1.6
Picture Memory	Score	12	3.3	14	5.5
Manikin	Score	17	0.6	18	0.8
Picture Completion	Score	13	23.5	14	21.6
Ship	Score	8	2.5	6	2.3
Color Discrimination	Score	9	12.0	13	12.5
Color Card Sorting	Score	6	13.0	8	36.3
Color Naming	Failures	4		1	
	Time, seconds	0		6	159.7
Picture Vocabulary	Score	12	29.3	14	30.1
Picture Genus	Score	5	14.0	3	4.7
Design					
Sight	Score	2	6.0	2	9.5
Memory	Score	3	4.7	2	7.0
Weight Concept	Score	6	9.2	8	13.4
Number Concept					
Test 1	Score	12	1.9	14	2.9
Test 2	Score	12	2.0	14	4.6
Test 3	Score	12	1.9	14	2.2
Test 4	Score	5	1.0	5	0.6
Test 5	Score	5	1.0	5	1.4
Test 6	Score	5	1.2	5	1.4
Time Sense					
Test 1	Score	5	3.9	3	3.6
Test 2	Score	5	2.4	3	3.0
	Total	5	6.3	3	6.7

and girls classed as six years differ only 0.1 month in chronological age, but the boys average 1.3 months higher in mental age and 1.4 points in I.Q. In respect to general intelligence the particular groups of girls studied are then equal to the boys studied at three years, superior at two, four, and five years, and slightly inferior at six years.

The age at which comparison of our results for boys and girls can most fairly be made on the basis of the mental tests is at three years, when they are about equal in chronological age and in general intelligence. This comparison is expressed in Table VII. The group of boys classed at this age is somewhat superior in card sorting, the Goddard form board, the mare and foal picture board, form cancellation, tracing path, the picture completion test, and the picture genus test. It is of interest to note that this group of three-year-old boys is inferior to the girls on the Montessori dressing frames. In general the differences in the test scores are small. If there are real differences at these early ages, they may perhaps have been concealed in the averages or may not be evident because of the coarseness of the measures used.

Correlations between Traits

Many questions of importance in the mental development of children can be investigated by means of correlation data, such as are given in Table VIII.* The number of tests reported in the correlation series is necessarily less than the total number discussed in Chapters III to VIII, since the range on some tests is too narrow to permit of correlation by the usual method.

Zero Order Correlations

The raw coefficients of correlation obtained by means of the Pearson formula are presented in the first column of each division of the upper triangle of

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* Table VIII will be found on an insert facing page 38.

Table VIII, with the corresponding probable errors in the lower triangle of the table. It will be seen that for this particular group of forty-one children the correlation between mental age on the first Stanford-Binet test and chronological age was + .86 ± .03, showing that the children who are older chronologically are older mentally. As may be seen from Table VIII, all tests show a positive, and in the majority of cases a fairly high correlation with both chronological and mental age. In a little more than half the cases, the ability to do the test is dependent more on mental age than on chronological age.

It would be impossible to discuss all the zero order correlations in detail. An attempt will be made in the following sections to analyze some of the factors influencing the correlations.

Partial Correlations with Chronological Age Constant

The size of the raw correlations between any two traits or tests depends on a number of factors, chief among which are the chronological and mental age of the child. In order to eliminate as far as possible the influence of chronological age, this factor was held constant by the method of partial correlation. The resulting coefficients of correlation presented in the second column of each section of Table VIII represent the degree of correspondence that would have existed if the children had all been of the same chronological age.

Stanford-Binet Test

The highest correlation with the mental age resulting from the first test of general intelligence, the Stanford-Binet, was + .57 for the Detroit kindergarten test. A fairly high correlation was to have been expected, since both are tests of a variety of functions that make up general intelligence. The Detroit test deals with concrete picture material, but resembles the Stanford-Binet in requiring a good understanding of verbal directions. Color discrimination correlates with mental age to the extent of + .45, probably because classifying the worsteds is a rather complex mental process, making unusual demands on sustained attention. The three-hole test, which correlates + .45 with mental age, is not very satisfying in itself, and consequently requires unusual attention and persistence, which possibly are more characteristic of children of greater mental development. The picture completion test is shown by the correlation of + .42 with mental age to be a better test of general intelligence than it appeared to be during the giving of the test. The development of the number sense is also apparently quite indicative of general mental development, the correlation with mental age being + .42.

Detroit Kindergarten Test

In analyzing the correlations with the second test of general intelligence, the Detroit kindergarten, it is seen that the highest correlation between this test and any other is + .54, with the first number test (matching), which is comparable with the correlation already found between number matching and mental age. Probably because of the common pictorial element, the Detroit kindergarten correlates + .44 with the picture vocabulary test. With the color discrimination test, which has previously been shown to be a rather complex one, the Detroit kindergarten correlates + .40. The other positive correlations for the Detroit kindergarten test are less than this. The effect of eliminating chronological age is to reduce the correlation between tests. With children of the same age the resemblance between many of these tests is much less than might be expected.

Partial Correlations with Mental Age Constant

In the third column in each section of Table VIII may be seen the effect upon the correlations when the influence of mental age is eliminated as far as possible. The effect of partialing out mental age, as if the children were now all of the same mental age, is to reduce still further the size of the raw correlations, showing that mental age has more influence than chronological age upon the size of the correlations.

Correlations Between Mental and Physical Traits

In Chapter II were presented the correlations among the physical traits of thirty-six boys from two to six years of age and fifty-three girls of the same age range. There was available for these children also the mental age on the Stanford-Binet test. As mental growth is very rapid at the preschool ages, it was necessary to calculate a hypothetical mental age to match the wrist-bone age. This was done by assuming that the I.Q. was constant over the short interval and correcting the mental age obtained at the examination nearest the time at which the roentgenogram was taken, just as the weights and heights were previously corrected. For the group of boys the correlation between height and mental age was +.86 ±.03, and for the girls +.80 ±.03. This simply means that in general the taller children were also the older and more advanced mentally. Both height and mental age are of course greatly influenced by chronological age. In order to get the exact relationship between them with the effect of chronological age eliminated as far as possible, the partial correlation was calculated and found to be + .25 for the boys and + .31 for the girls.

The correlation between weight and mental age was for the boys + .72 ± .05 and for the girls + .76 ± .04. The

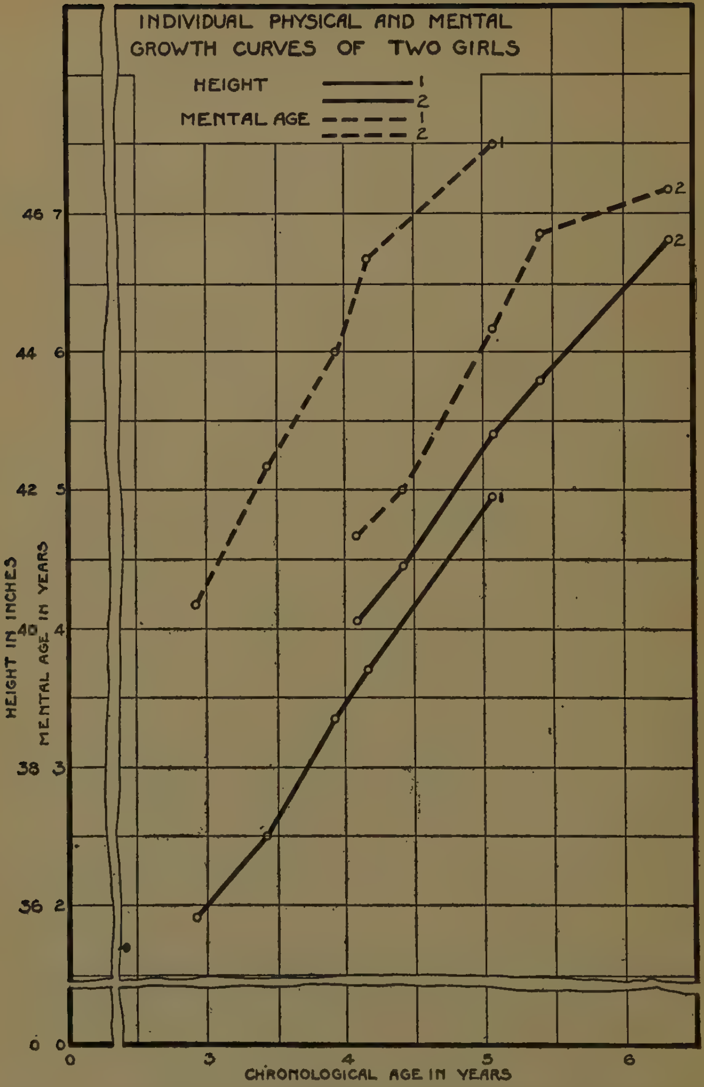

FIG. 44. THE INDIVIDUAL PHYSICAL AND MENTAL GROWTH CURVES OF TWO GIRLS.

partial correlation between weight and mental age with chronological age eliminated was for the boys + .14 and for the girls + .33. This means that the apparently close relation between weight and mental age as shown by the raw correlation is largely dependent upon chronological age.

The correlation between carpal bone area and mental age was for the boys + .58 ± .07, and for the girls + .73 ± .04. The partial correlation with chronological age eliminated was for the boys — .14 and for the girls + .21, which indicates that the relationship between carpal bones and mental age as shown by the raw correlations is greatly influenced by chronological age. It would seem then that there is a slight positive relationship between height, weight, and mental age, and probably no relationship between mental age and carpal area.

Figure 44 presents individual growth curves in height and in mental age, as shown by consecutive measurements for two girls of different physical types, one a girl of superior mentality and of small stature and weight, and the other a girl of average mentality and of average physical development. It will be noted that the curves maintain a relatively constant level and trend.

CHAPTER IX

DAILY PROGRAM AND LABORATORY EQUIPMENT

Daily Educational Program

As has been explained in Chapter I, there are three groups of children in attendance at the preschool laboratories, the first of children two to three years, the second of children three to four years, and the third of children five to six years, with the four- to five-year-olds divided between the second and third groups.

The first group of children is in the preschool laboratory from nine to ten :thirty daily, five days each week. The group rooms offer such a diversity of interests to a young child that its first reaction is likely to be considerable bewilderment before all these delights. Here is a collection of simple materials with which to play and sympathetic companions to share the activities. A very shy child is likely to take a plaything into one of the little coops made by the gates hinged to the sides of the room. The more active child crawls on the floor with building blocks, or plays at the sand table, or uses the slide. Gradually the children become acquainted with their surroundings and their companions and are ready for some group activity. It is noticeable, however, that each morning there is a reversion to the less social attitude of investigation of the environment and individual play.

About nine :fifteen the nurse comes for inspection. For some children this is a great trial, especially learning to open the mouth wide and stick out the tongue. The children soon learn to run up to the nurse and after this are ready to be rather more social. They draw their chairs around the phonograph when music is played (Fig. 32). A brief social gathering of this kind under the guidance of the two teachers is really needed for producing the proper *esprit de corps*. Clapping hands in time to the music, answering "Here" for roll call, trying to count the number of children in the ring, and trying to remember the day of the week so the day's rime can be read off the calendar, are all great fun. This is also a good time for a short story or for finger plays (Fig. 45). Some days there is singing with the phonograph, Mother Goose songs about the figures on the curtains, or other little rimes that the children enjoy singing at home. Sometimes it is just talking about a picture of carpenters at their work or of cows in the country. Later there are singing games and skip-

FIG. 45. FINGER PLAYS.

ping. Some very interesting project comes next—perhaps cooking cocoa, making something pretty for the group room, or molding and coloring marbles.

Soon it is time for the children to go to the lavatory and wash. Then they get ready the tables and chairs for lunch and carry in the milk bottles and cups. After lunch there is a rest in the playhouses with music. When the phonograph plays a very jolly tune the little children understand that it is time to get up and say good-by and put on wraps. They do this, as far as possible, without help.

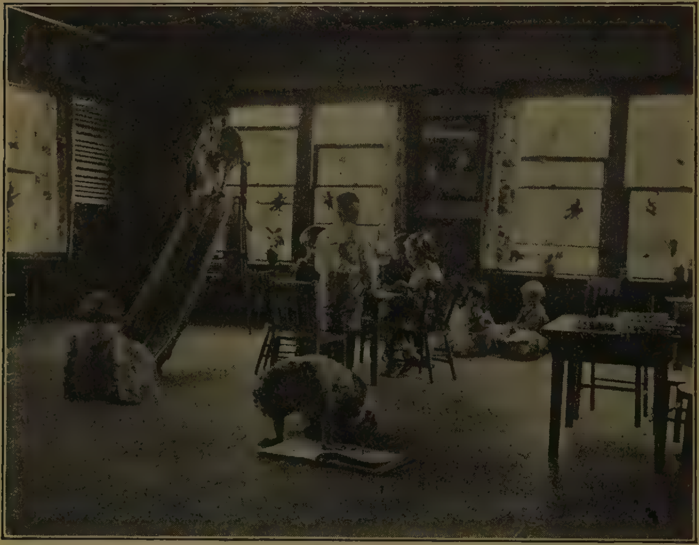

FIG. 46. THE BEGINNING AND END OF A SLIDE.

The children of the second group begin coming about ten: thirty for a somewhat similar program. After inspection by the nurse, the first half hour is spent in free play, sliding, dressing the dolls, "playing house," and looking at picture books (Fig. 46). By eleven o'clock everybody is ready to get together and exchange ideas. At this age the children are able to enjoy rather longer and more complicated stories, to tell their experiences to a group, and to dramatize simple action plays.

The more mature group enjoys a realistic orchestra and is able to execute various rhythms with some approximation to correctness. They can work at projects requiring sustained attention and a continuity of effort from day to day.

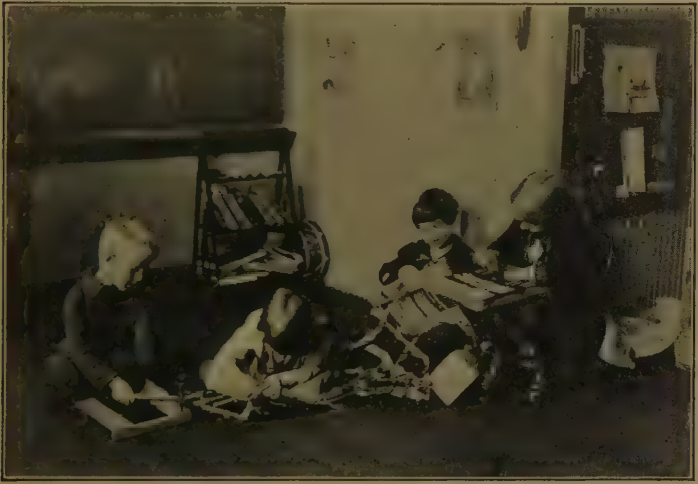

FIG. 47. RUG WEAVING IN THE JUNIOR PRIMARY LABORATORY.

Such a project as getting ready for a party with the junior primary requires the ability to hold a problem in mind and to work toward a remote end. Ideas obtained from group excursions to interesting places in the neighborhood and from home experiences are utilized in constructive activities within the laboratory. Cleaning up the room and a brief rest to music finish the morning.

The third group, known as the junior primary, attends from nine until twelve o'clock five days a week. Immediately after inspection by the school nurse the children usually settle down to a so-called work period. Each child is helped to feel a responsibility toward accomplishing something every day, and discouraged from aimless wandering around without some definite objective. This work may consist of performing various room duties, for example, dusting, arranging flowers, feeding pets, or making little conveniences for the room, such as a dust bag, a bulletin board, or a window box. The work may be weaving on looms (Fig. 47), drawing, working with plasticene, practicing writing, or reading. Sometimes this period is used for the more formal group work designed to introduce the children to some new activity, such as use of the reading material or the proper writing movements. The children are given individual help with selecting and starting their work, but when they understand their tasks, they are expected to show considerable concentration and prolonged effort.

On four days a week music follows this period. On the fifth day a longer science period is held. This sometimes consists of a talk or experiments on some interesting nature material, excursions to see certain stones, fossils, or formations, or to watch the development of the trees, flowers, and plants. The group has kept in touch with the changing forms of the river in the fall and in the winter and spring, watching with interest the formation of ice and its later destruction. Frequently there are excursions to the museum and bird hall or such places as the botany laboratory and the physics building to see specimens and experiments. Recess and physical education follow. Later milk is served "party" fashion by the children themselves, and attention drawn to good manners. A few minutes' rest period precedes the conversation period. During this time the children sit quietly or lie on mats on the floor.

At the beginning of the year the conversation period was, of course, most informal, each child wishing to tell some news or interesting happening. Later groups were formed for listening to certain children, and the idea of having a responsibility in listening was felt for the first time. This attitude was fostered by the children's attendance at the regular Friday morning assembly period of the entire elementary school, both as audience and as participants in the program. Soon after the first program was presented by the junior primary the children began to get a feeling for organization in their conversation periods and it was suggested that there be a regular language period. This was worked out rather satisfactorily, by having the child who was talking stand at the front of the room, facing the group, all of whom were required to give good attention. If any child had a contribution to make it stood by its seat, and was recognized by the speaker, instead of interrupting. Starting with the rather embarrassed and self-conscious attitude so prevalent among children not used to talking before people in this manner, there has evolved an easy delivery on the part of the child talking, while the interest and self-control manifest on the part of the children who are listening is a good criterion for judging their growth in this respect.

The subjects for conversation vary all the way from interesting happenings at home or on the way to school to topics discussed in science periods or on trips and excursions. Sometimes the idea for discussion is suggested by the teacher, some health topic, or how to play a certain game. These conversations have served to give a very good check on the children's vocabulary and information, as well as on their ability to observe the particular things being studied.

A short art period is followed by a half hour spent in listening to the teacher read stories or verses or in hearing other children tell stories. The quiet attention paid in this literature period even after a busy morning testifies to the children's enjoyment of this activity.

The program for the day is always very elastic, changes being made to suit the children's varying interests and to permit of activities appropriate to various seasons and festivals. In general the program can be summarized as follows:

8:50 to 9:00....Inspection.
9:00 to 9:25....Work (reading, number writing, handwork).
9:25 to 9:35....Music or science.
9:35 to 9:50....Science.
9:50 to 10:15....Recess and physical education.
10:15 to 10:20....Milk.
10:20 to 10:25....Rest.
10:25 to 10:55....Conversation.
10:55 to 11:15....Art.
11:15 to 11:45....Literature.

Apparatus, Furniture, and Equipment

The preschool laboratories are as comfortable and inviting to young children as the ideal home nursery, and they provide in addition an abundance of special play apparatus, furniture, and equipment that is not ordinarily to be expected in a private home.

Playground Apparatus

The large sunny yard back of the preschool laboratory building is furnished with swings and a teeter for outdoor play periods (Fig. 48).

Swings.—The swings consist of a frame, from which hang two small chairs. The swing seats are set 12 inches above the ground.

Teeter.—A see-saw has been cut down so that the board when parallel to the ground is 18 inches high.

The teeter and the swing are both very popular with all ages of children and furnish endless occupation in the directed play periods during the warmer weather.

Slide.—The slide was cut down for the use of small children so that the polished hardwood board descends directly to the floor from an elevation of about 5 feet. The ascent is by means of a ladder ending in a small platform at the top of the slide, provided, like the board and steps, with a hand rail on each side. The portable slide has proved to be secure and durable, and very convenient for play room use. It is interesting to every child. Attention can always be turned from an undesirable activity by the suggestion, "Why don't you slide?" The slide is almost unique among the various materials used, in calling out some display of originality, from even the youngest and least developed of the children. Although at first they were happy to sit primly on the slide and descend gently, in a short time the methods of descent were as varied as the children and their moods, now fast, now slow, according to the vigor of the take-off, now lying on the back or stomach, head first or feet first, now holding out the arms

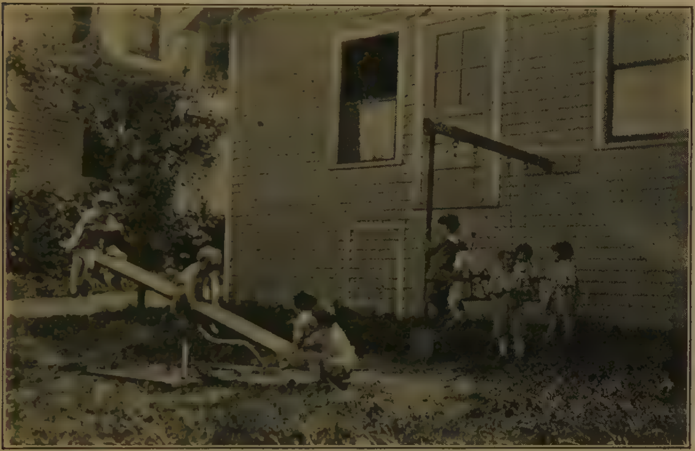

FIG. 48. OUTDOOR PLAY.

and legs. It is also considered excellent fun to slide the dolls and animals that frequently accompany their young owners to school. The small platform at the top makes an excellent look-out station, and the children seem to get real pleasure from standing posed there surveying the room.

"Take your turn," "Don't push," and "One at a time," have proved adequate in the way of government and very little trouble and no serious bumps result from the use of the slide. Adult supervision is scarcely necessary after the first few weeks.

Furniture

It is of considerable importance that the furniture for the use of young children should be of convenient size and adapted to their play needs.

Chairs and Tables.—In the rooms used by the two younger groups the furniture consists of small chairs with seats 12 inches from the floor, and low tables 20 inches by 36 inches and 24 inches high. Besides the small chairs there is a low rocker with sides cut and painted to represent a large duck. The youngest children seem to enjoy the rocker, as it provides safe and easy motion, but it does not offer sufficient variety to the more active ones, unless they rock in such a manner as to make the chair move across the room. It passes through waves of popularity during which every child wants to use it and again it is neglected for days.

Each child in the junior primary group has a movable combination chair and desk. This has a drawer under the seat where the child can keep materials. Small folding chairs and a folding shelf table furnish extra work places when needed. The children are not generally required to sit in the chairs, but use the floor when it is more convenient.

Sand Table.—A low table, 3 feet wide, 10 feet long, and 22 inches high, topped by a shallow zinc-lined box, and filled with fine white sand, makes a work bench with a never-failing supply of material. Smooth pebbles of various sizes, shells, small wooden blocks, aluminum cups, cookie-cutters in a variety of shapes, doll-sized cake pans, large bottles, and a funnel are supplied. With this material the children, especially the younger ones, are happy for even an hour at a stretch, but they show very little originality in its use.

Filling and refilling the bottles with sand is the constant occupation of several of the youngest children. This process seems to have very little imaginative meaning for the child, but is satisfying in itself primarily because of the pressure contacts of the sand, the sight of the succession of moving particles, and the feeling of control when the sand is caught and held fast within the walls of the bottle.

The older children are interested in little dramatic plays at the sand table, but the suggestion always comes from adults. Contrary to the popular belief, small children show very little imagination in the creative sense. Once a suggestion is given to them, they are happy to repeat the old "play" every day. "Taste my cake" is a constant plea, as the small bakers, both boys and girls, proffer their carefully filled cake pans. The idea that the smaller pebbles are like raisins is eagerly seized upon and thereafter each cake is "raisin cake." On George Washington's birthday, the teacher and the children enacted the drama of cutting down the cherry tree on the sand table, and from that time to the end of the school year, one small boy planted trees and chopped them down every day, as often as his attention was not held elsewhere. No such elaborate creative activities as those of the older children in G. Stanley Hall's *Story of a Sandpile* were observed in these young children.

The children very soon learn to handle the sand carefully in order not to have it fly into any one's face, but it takes longer to learn coöperation and compromise when limited material or space leads to mild conflicts. If one child wants all the sand to make an enormous mountain and another wants to fill all the pans and bottles, the solution is hard for the children to grasp, and the suggested sharing requires a great effort at self-control. Toward the end of the year the children learn to adjust these conflicts themselves. Altogether we believe that a distinct moral gain has been made when as many as twelve children at one time can play peaceably and happily about the sand table (Fig. 49).

FIG. 49. THE SAND TABLE PROMOTES SELF-CONTROL AND COÖPERATION.

Sand Tray.—A tray that just fits under the sand table furnishes space for more permanent projects, such as the model farm. There is a tightly fitting lid which prevents the destruction of the project between times. Casters permit the tray's being rolled out into the room for group use.

Lattice Pens.—The little enclosures made by the lattice gates in the play room for the two younger groups have already been described with the general plan of the building. The instinctive tendency of young children to get into places where they will be, as Thorndike says, "not entirely unenclosed," is shown in the way in which the children delight in playing in these little pens, especially the corner ones. A lattice roof has been arranged so that it can be let down by a pulley over one of the corner pens. A long narrow closet with two doors is likewise used as a play house. The children also use the space under the slide, crowding in as many chairs and children as possible.

Blackboards.—Large boards are set low around the walls. For the two younger groups these are so low that the children can sit on the floor and draw on them. They are always popular for individual drawing among the younger children and for practicing letters and numbers among the older ones, and are indispensable for illustrating the morning talks and the science work.

Equipment

Much of the equipment that has been found useful in modern educational experiments with children of kindergarten age is found in the laboratories. Some of the more conventional kindergarten materials have also been included with a view to studying their appeal to young children and their possibilities as an index of development along motor and other lines.

Phonograph.—The phonograph and records on a low stand are easily accessible to the children, and they are

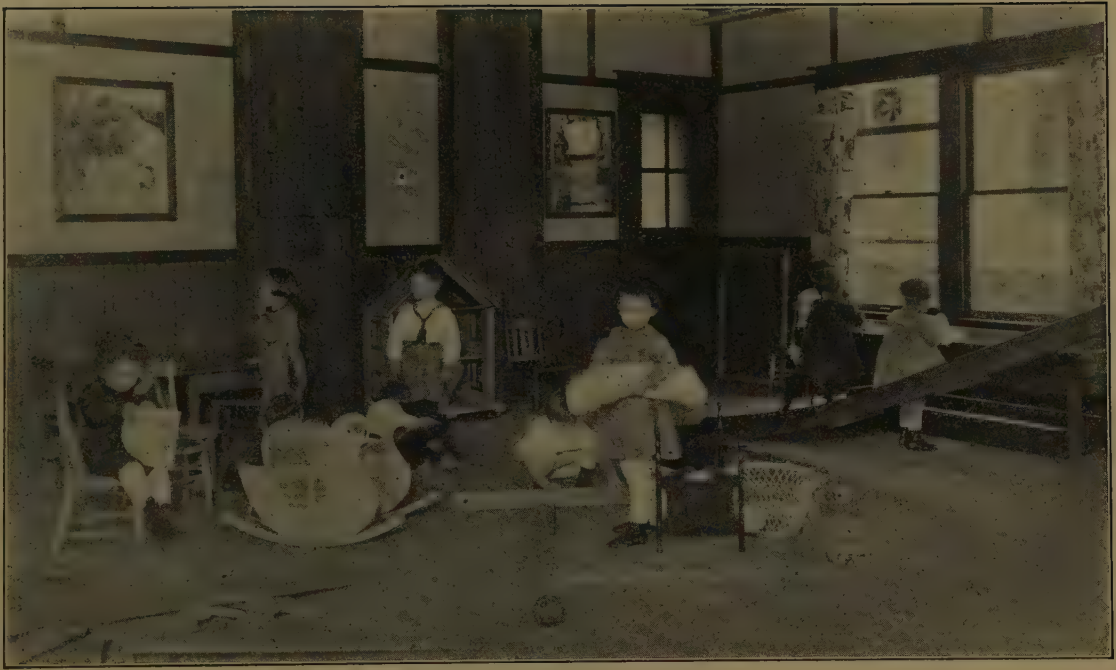

FIG. 50. PLAYING HOUSE.

taught to handle the records and operate the machine as part of the regular training.

Doll House.—The open-front doll house set on casters to permit of its being rolled into a convenient position for group projects contains four rooms, 12 inches on each dimension, and a double attic with a pointed roof. Each room has at the side a glass window. This house forms a permanent place for all sorts of constructive activities.

Dolls.—A large cylindrical pillow with a washable slip serves as a rag doll. The slip has features embroidered on it for a face and a draw-string to make the neck. The younger children like this doll because it is soft and pleasant to handle, but it does not seem to have enough personality to acquire a name or enough human character to evoke "mothering" behavior. This rather abstract doll, theoretically so correct, illustrates very well the danger of oversimplification in toys for young children. What seems admirable to the adult because only the essential elements are present, often to the child lacks reality. Some very lifelike indestructible dolls have been added to the equipment with resulting satisfaction to all the children. Dolls from home furnish a large part of the interest during the first part of the morning, as many children come with their "babies." A basket-bed and a cradle, with mattress, covers, pillows, and bed linen is ready for the use of any doll. Some of the children bring dolls and doll beds from home during the season of especial interest in housekeeping (Fig. 50).

Housekeeping Equipment.—A small tea set, spoons, and a tea cloth are ready for parties. A dustpan, broom, and brush are in everyday use. The laundry equipment of tubs, board, wringer, line, and iron are used for laundering tea towels, the doll's bed linen, and clothes. Wood, nails, saw, hammers, and yardsticks, together with glue and twine, furnish all the equipment necessary for a number of projects in construction. Needles and thread, and a collection of pieces of cloth which the children have brought from home are used for making things needed in the group rooms and a complete wardrobe for the dolls.

Scissors.—Usually very few of the children in the first two groups have had scissors to play with at home. For them rounded scissors are provided. The youngest children scarcely perfect the hand coördination in all the months in the laboratory. The opposition of thumb and forefinger is very difficult for them, and even when this is learned the little stubby hands do not have enough strength to cut the paper, which just slides between the blades. Children who have mastered the cutting movements often can not cut along a straight line. They first use the scissors clumsily and snip off bits of paper. Later they begin to notice the outline on the paper and make a few crude attempts to approximate the shape. Pumpkins, snow men, stars, and hearts cut out by the children at this stage show very jagged outlines. Free-hand cutting of ovals for Easter eggs has been attempted, and the results are a weird collection of squares, polygons, and unnamable shapes. The children seem content to clip off a piece of paper from the sheet given them, color it, and call it an egg, regardless of shape. With increasing maturity and practice, the outlines become smoother and by the end of the year most of the children can cut out along a line to produce something with a recognizable shape. The older children are even successful in cutting cloth according to a pattern.

For the junior primary group a supply of small pointed scissors is provided. Most of the children already know how to use scissors, but their skill in following an outline varies greatly. They are all able to make fairly presentable cut-outs by Christmas time.

Blocks.—The laboratories are provided with an assortment of large blocks selected from the Patty Hill Floor Blocks. The smaller square, rectangular, and triangular blocks and the odd scraps of wood that are always kept on hand lend themselves to a variety of games. Left to themselves, the children lay the boards on the floor to make beds, barns, houses, or railroad tracks, or use them as broomstick horses. Bridges are made over chair backs, and towers are piled up and tumbled down regularly. There is also a special set of geometrically shaped blocks, including one round block marked like a face with eyes and mouth and with a removable peg for a nose. A booklet of weird animals and human figures to be made from the blocks is provided with the set. Most of the children not only do not invent figures, but can not even copy the patterns provided. These blocks are used with the larger blocks for constructing the usual houses and block piles. The head block is interesting to the younger children, who spend much time putting in the nose peg and pulling it out. The children seem to find as much pleasure in getting out and putting away the blocks as in actual play with them. They handle the rather heavy pieces of lumber well, and all coöperate in clearing away the blocks in a very short time.

Balls.—A multicolored rubber ball about 8 inches in diameter is a toy that interests the children for individual and group play. Two children of the first group roll or toss the ball to each other, but if three or four children join the circle, supervision is necessary to keep the game together. The children of the second group roll the ball from one to another around and across a small circle, but the periods of inactivity between turns prove dull to them, and they seem to have no interest in watching the success of the others in rolling straight or catching, but are interested only in their own achievements. The junior primary children, on the other hand, really enjoy a group game and even appoint one of their number as leader.

Soap Bubble Materials.—Clay pipes, castile soap, and a large shallow pan set in the sand table make an adequate soap bubble outfit. The youngest children have little success in blowing out, but suck in the soapy water just as they drink milk. The three- and four-year-olds are very fond of the game and some become quite expert at making large bubbles. There is a great deal of individual difference in the interest in this play, all the way from one small girl, who asks regularly upon arrival, "Shall we blow soap bubbles today?" to the boy who, though he can blow very nice bubbles, always says after the first success, "I'm through." In general the older children are not so much interested in the game.

Lacing Cards.—These are heavy cardboards perforated with large holes in rows and simple patterns. Through the holes brightly colored shoe strings are to be threaded as in sewing, for which this is a preparatory exercise. The younger children have difficulty in remembering to go into the holes from opposite sides of the cardboard and consequently wind the strings around the edges of the cardboard. As soon as the children have grasped the idea of alternation and acquired sufficient manual dexterity to make the pattern of holes they lose interest as the finished product seems to have no obvious use.

Sewing Cards.—These are light cardboards with simple designs in fruit and flowers pricked for outlining with gay colored threads. Cards such as these used to be the stock in trade of the conventional kindergarten and they are so attractive to adults that it is hard to believe children do not particularly care for them. They make interesting material for observing the use of the needle. By the time these cards are used, the children have had some experience in stringing popcorn for decorating the Christmas tree, and even the youngest have been able to thread eight or ten grains. Putting the needle up and down through the holes in the sewing card is a more difficult performance and as it leads to no obviously useful result is not particularly enjoyed. As with the lacing cards, the children find it hard to remember to put the needle through in opposite directions and frequently wind the thread around the card. In all this work a double thread with a knot is used, the needle, of course, being threaded by the teacher.

At first thought, it might be considered dangerous to give such young children needles, but under supervision accidents do not occur. Another danger might be considered in this connection: the supposed fatigue to the nervous system of such young children from the use of the muscles involved in the finer coördinations. It has been a psychological theory that children use first the larger muscles which developed first in the history of the race. Our observation of the activities of children does not support this contention. They will be found indulging in and enjoying all sorts of fine motions, trying to stick pins into the dots on a figured pincushion, running something between the teeth of a comb, picking up small particles from the floor, poking things into small cracks. No apparent harm has come to children who have been allowed to occupy themselves so at home. The chief point seems to be not to carry any activity, whether it be of small or large muscles, to the point of fatigue.

Paper Weaving Materials.—The weaving of colored paper mats which used to hold so important a place in the older kindergarten has made little appeal to our preschool children. The younger children can be kept interested only by constant adult attention, and the older ones ask the very pertinent question, "What good are they?" The activity as such is apparently not an end to the children, but they become more interested in the idea of making rugs for the doll house.

As in other projects requiring the concept of design, the idea of alternating the two colored strips and of reversing the procedure at the second line presents real difficulties. The younger children often slip a strip under the entire mat and do not understand how to make it come out again. The task requires great motor control in inserting the weaving strips without tearing the mat and in keeping the weaving strips from slipping through like a thread without a knot.

Sticks, Parquetry, and Rings.—Boxes of colored sticks, small geometrically shaped pieces of colored wood and cardboard, and steel rings and broken rings interest the children when they want some quiet play. They enjoy heaping up the colored bits, picking up a handful, and letting them run slowly through the fingers. They jingle the rings and use the large ones as bracelets, but can do surprisingly little in the way of construction, and always ask some adult to make something pretty for them. If the teacher makes a windmill or a rose or a fence of half circles and sticks, the children are eager to do the same and so acquire a few stock patterns that they use day after day. One very original child constructed a pair of glasses by joining two circles by a half circle, but such occurrences are rare. The idea of design is just as difficult to give the children here as with the beads. They seem unable even to copy a repeated motif. The use of this material furnishes an opportunity for the development of some of the social virtues. At first the children can not get the notion of taking only what they need from a common stock, but appropriate as much as possible without regard to what the project requires. Through play in the group coöperation becomes increasingly evident.

Beads.—For the younger children a box of large wooden beads, cubes, spheres, and cylinders in six colors is a daily joy. When the beads were first introduced the younger children found it very difficult to thread the end of the shoe string into the hole. A further difficulty, the slipping off of the bead at the other end, was conquered by having the teacher tie a bead at the end as a stop. Stringing a necklace on the shoe strings and wearing it until going-home time is an everyday occurrence. Even the older children use the beads very often. As shown by the test, preceding the free use of the material, it is not possible to give the younger children much idea of design, either by form or color. The beads are strung hit or miss, and the children seem to admire the finished product quite as much as the strings which the teacher helps to make of alternate red and blue or of round and square beads.

Modeling Clay.—The composition material in bright colors that is everywhere sold for modeling clay was first tried. Later powdered clay was mixed and used. The first reaction of the children was that of complete bewilderment. They had no idea of what to do with it and, as with the other material for constructive imagination, waited for the teachers to make something for them. Under adult stimulation they acquired a repertoire of pancakes, snakes, baskets, and rings of small spheres called beads. This was run through over and over with such additions as were suggested from time to time.

Pencils and Crayons.—The children like to "write" scrawls and scratches with the pencils on paper and often offer to draw a dog or a house. Of course, the product usually has no resemblance to the thing attempted, but they get fun out of the movement and the simple marks, no matter how poor the result.

Tracing around stencils and connecting dots to make drawings has proved too difficult to hold the interest of the younger group. Coloring simple shapes with crayons supplies a more natural form of expression. Coloring a figure means at first putting a few marks in a circle at the center of the figure. Later, upon being helped several times, the children learn the back and forth movement and so are able to get even into the corners and close to the edges. The ability improves rapidly, and toward the end of the year the older children do very smooth and careful coloring on some cut-out figures of birds and foreign peoples. An attempt to have the children make a crude sort of flag pattern with red and blue stripes alternating showed that the children had great difficulty in remembering this alternation and often gave near-lying stripes the same color.

Clock.—A large cardboard clock dial with movable hands is useful in connection with a real clock for developing time concepts.

Courtis Reading Material.—A complete supply of the reading material and supplementary work is ready for the time when reading is begun in the junior primary.

CHAPTER X

EDUCATIONAL ACTIVITIES

Occupations for the Younger Child

In the following sections the group room activities of the younger children are described under the head of language, nature experience, physical education, musical experience and training, æsthetic experience, and construction.

Language

Literary Appreciation.—The story material useful for the preschool child is limited. The usual child of this age will not listen to a story read out of a book, but has to be told the story in a simple, natural manner by a person who is looking at it and commanding its interest. The story can not be too long as the child becomes fatigued, or too complex, as it can not hold in mind much detail. The preschool child likes simple homely incidents with an amount of repetition that is really wearisome to an adult. Our children enjoy simple versions of such stories as are illustrated by the pictures on the group room walls, Puss in Boots, Jack and the Bean Stalk, Tom Thumb, Cinderella, and the Three Little Pigs, or the nursery rimes illustrated by the figured curtains. Some of the nature stories from Poulsson's *In the Child's World* and some of Stevenson's child verses are also usable.

In Lucy Sprague Mitchell's *Here and Now* story book, with its excellent advice to story-tellers, is found a collection of story material which actually works with children of the earlier ages. A group of three-year-olds will listen for ten minutes to a recital of "How Spot found a Home," or "Marni takes a Ride." These stories form excellent simple patterns which can be enlarged and adapted to various themes. A whole series of cat and dog adventures may be patterned on the Spot story, each with its simple refrain. Another favorite is about a little red star who keeps himself awake all night by peeping in the windows at the various children of the group, and kissing them as they sleep. "And the little red star saw Carolyn sound asleep in her little bed, and he kissed her on the tippy top of her little nose." The children also enjoy imaginary shopping expeditions, on which each member of the group repeats a little formula of purchasing various articles.

Dramatic Play.—Some finger games (Fig. 45) such as those given by Poulsson in *Finger Plays* are enjoyed, although only the most simple movements can be made by the short clumsy fingers of the children. An example of a successful game of this type is:

MOTHER'S KNIVES AND FORKS

[All sit on floor in a circle. The backs of hands are together, the fingers crossed alternately.]

"These are Mother's knives and forks,"

[Turn hands over, keeping fingers clasped, and flatten top.]

"This is Mother's table,"

[Raise both little fingers, bringing them together at tips.]

"This is sister's looking-glass,"

[Keep little fingers up and raise forefingers.]

"And this is baby's cradle."

[Rock cradle gently back and forth.]

"Rock-a-by-Baby, by."

During the singing of nursery rimes the children enjoy action, such as pointing to the little star, which is "like a diamond in the sky,'' or pulling out the plum with Jack Horner.

The older children are delighted to take part in dramatization of the simpler Mother Goose rimes. Although only two characters are required for little Miss Muffit, it is difficult to know who enjoys the play most—the audience of children who recite the verse, the spider who has the delightful job of crawling around on hands and knees, or Miss Muffit herself, who screams with joy at the sight of the spider. Again, the King in his counting house, the Queen who eats honey, and the maid whose nose is nipped off by a blackbird, not to speak of the blackbird itself, are favorite rôles. A considerable degree of coöperation is required of the six children who act out old King Cole as he calls for his pipe, his bowl, and his fiddlers. Although the children can put on a perfect performance when some adult manages the ''show,'' they are not quite old enough to give each other their cues and they are never observed to be carrying on these particular dramatizations spontaneously. They frequently, however, enact the familiar children's drama of playing house, with one particularly active little girl, a minister's daughter, as the mother getting the children ready for church.

Nature Experience

Nature Talks and Experiments.—Much nature material is brought into the laboratories by the children and the members of the staff. In the fall, flowers, nuts, pine cones, Osage oranges, seed pods, and the like furnish subjects for the morning talks. Sea shells, pebbles, and such curiosities are discussed when there is little growing outdoors. In the spring, bird nests, pussy willows, blossoms, tadpoles and other evidences of renewed nature activity form the basis of talks about the seasons, which are very poorly distinguished by the younger children. The plants growing in boxes and pots on the low window sill are discussed in detail. The children are eager to water the plants whenever an adult suggests it, but do not as a general thing remember to do it themselves.

In the fall they all assist in preparing the ground for bulbs and plant a row under the laboratory windows. These growing plants are watched and tended with great interest in the spring. The children plant a window box with seeds and enjoy watching the fast growing plants. Pansy plants already in blossom are also set out by the children. Picking the pansies and arranging them in dishes for the laboratory is a coveted duty.

The animals that are brought or that stray into the laboratory also furnish the starting point for talks, as do also the birds which are interesting perhaps because of the rich associations resulting from coloring the cut-outs, seeing the pictures, and learning to identify the bird calls.

The history of laboratory pets is a succession of passing wonders. The goldfish bowl was first a center of eager interest, and the movements of the fish seemed to furnish inexhaustible pleasure, especially to the younger children. Later, two white rats helped to prove that children are not instinctively afraid of such animals, since they handled the rats and allowed them to crawl over their shoulders. Two small turtles in a basin of rocks and water were for a few days devotedly furnished with flies and anything else the children considered edible. A pigeon that often flew into an open window and a cat that was accustomed to sit on the sill were given every attention for a short time. It has been found impossible, however, to delegate any such household task as feeding the animals to children of this age and rely upon its execution. The children are delighted to feed the pet upon suggestion, and when the animal is still something of a curiosity spend much time with it. Afterwards the laboratory experience simply duplicates that of countless disappointed parents who have provided pets for such young children. Pets doubtless have their educational value, but too much responsibility for them should not be expected of children in these early years.

Excursions.—The University greenhouse (Fig. 51) proves of great interest to the children who have never seen so many growing things at once. A collection of tropical plants leads up to conversation about the vegetation of the hot countries.

FIG. 51. AN EXCURSION TO THE GREENHOUSE.

Every spring all three groups make a visit to a farm, an entirely new experience to most of the children. The large numbers of chicks and little pigs delight them. Strangely enough, they are rather afraid of the farm horses, large animals of this sort being out of the range of experience of modern city-dwelling children. The calves arouse lively interest and almost all of the children walk up and pet such of these frolicsome animals as can be persuaded to stand still.

The University has a fine natural history collection with life arrangements of animals and plants in their natural settings. The trips to the museum are probably the most important educational feature of the nature study. The following extract from the log conveys an idea of the children's reactions on such a trip:

> April 7, 1922. A trip was made to Bird Hall (University Museum). The swamp exhibit attracted more attention than any other feature, with the owls in the tree as a close second. The children were intensely interested in the alligator, the frogs, and the little birds on the nests. Many questions were asked about how the owls lived in the tree, what they did when it rained, and so forth. Some birds were identified unaided by the children, among them, the peacock, owl, and parrot. Some of the children ran from one bird to another without stopping to examine any, while others looked at everything as they went along, noticing different features and calling the others back often with, "You didn't see this one," or a similar remark. One child just ran around and paid little attention except when attracted by a bright color.
>
> The older group were more interested and had more knowledge of the birds than the younger group. They found many things of interest which escaped the younger group until pointed out. They identified many birds and animals—owl, turkey, parrot, crocodile, frog, snake, rabbit, duck. The whole group stayed together and enjoyed the exhibits, with scarcely any scattering such as occurred all the time with the younger group.

Physical Education

Almost all rhythmic physical activities performed in concert by a group have a socializing value, as the child gets some feeling of being part of a group.

The first physical education periods are spent in learning to march to the accompaniment of a march record played on the phonograph. It is interesting to see that children of the earlier ages have no conception of what it means to keep in line behind one another. If the children are lined up in a large circle and set to marching around the room, they are soon wandering about by themselves with no reference to each other. It is a great step in advance when the children come to feel themselves a part of a group, all of whom are doing the same thing. Of course, there can be no question of keeping step or of marching in time to the music at first. As the children develop, the marching is complicated by having the leader carry a flag, the common soldier boy game, or by having the children imitate various instruments in a band—a spectacle with which they are familiar as they have seen the University Military Band marching the streets. Other variants are running in a circle and walking with knees bent, arms held up, and wrists dropped.

The children find it very difficult to stop going in one direction and go in the other. To afford practice in this, they sing and act out the rime:

Three funny old men from our town
Went out for a walk one day;

But the wind blew so strong
That it blew them about,

And they walked the other way,
And they walked the other way.

From the walking motions, skipping is developed by means of having the children say together the following action-rime, lifting the feet high as they walk:

This is the way to London town,
One foot up and one foot down.

A hop inserted at the appropriate moment goes well with the following rime:

Hippity hop to the barber shop
To buy a stick of candy,
One for you and one for me
And one for brother Andy.

Following this the children enjoy imitative plays, such as are found in Moses' *Rhythmic Plays and Dances.* In the following examples the children recite the verse in chorus.

HUMPTY DUMPTY

[All get down on knees in circle and cross arms in front of chest.]

"Humpty Dumpty sat on a wall;"

[All tumble over on floor.]

"Humpty Dumpty had a great fall;"

[All jump up quickly and trot in place like horses.]

"All the king's horses,"

[Stand straight and tall.]

"And all the king's men,"

[Shake heads negatively.]

"Couldn't put Humpty Dumpty together again."

TALL AND SMALL

[Stand on tiptoes and stretch arms up over head.]

"Sometimes I'm tall,"

[Arms down and bend knees low.]

"Sometimes I'm small,"

[Stretch up high again.]

"Sometimes I'm very, very tall."

[Down low again.]

"Sometimes small."

[Stretch up again.]

"Sometimes tall."

[Down very low.]

"Sometimes I'm very, very small."

The children enjoy the singing games to phonograph accompaniment. Particularly successful are:

Looby Loo
Oats, Peas, Beans, and Barley
The Muffin Man
Soldier Boy
Round and Round the Village
Let us Chase the Squirrel
Did You Ever See a Lassie?
London Bridge
Round the Mulberry Bush

The records for these games are listed in Appendix III. Directions for playing the games are found in the appended list of books, which contains much material suitable for physical training for children of preschool ages.

Musical Experience and Training

Music is played for appreciation, and the habit is early established of listening quietly, and not indulging in activities of one's own while music is going on. It is a question whether much of the inattention of children at concerts is not due to their being permitted at home and elsewhere to ignore music that is being played. A list of records particularly excellent for preschool children is also given in Appendix III.

The records grouped under "Appreciation" are used principally during the overlapping period, while the first group is getting ready to go home and the second group is waiting for the morning exercises to begin.

The descriptive pieces are usually employed during the group exercises, when all the children enjoy analyzing the music, recognizing the noises of dogs, running horses, spinning wheel, and so forth. In connection with the bird songs and calls the children are shown the pictures of the birds and they soon associate the appearance of a bird with its note.

The nursery rimes are used as a basis for group and individual singing with gestures. Almost all the children learn a dozen or more of these rimes and can sing them with "the lady," as they call the record, or can carry the tune alone if "the lady" starts them. It is remarkable to see even the youngest children sing for their companions without shyness or self-consciousness. Other attractive songs, with piano accompaniment, for young children will be found in the books listed in Appendix II.

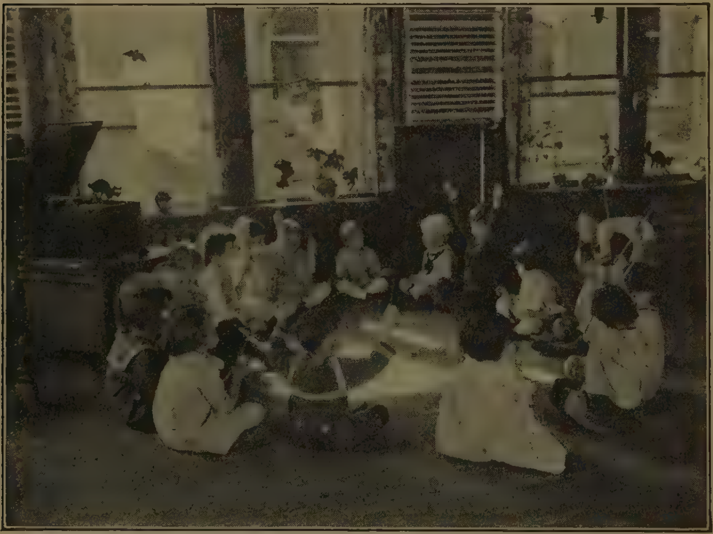

FIG. 52. AN EXERCISE IN RHYTHM FOR THE GROUP.

The marches are sometimes used during the morning exercises for a sort of rhythmical "Follow-the-leader," in which the children play various imaginary instruments, as indicated by the band leader (Fig. 52). Playing the violin is represented by a crosswise movement, the horn by a sliding arm movement, the drum by clapping the hands on the knees, and so on. Drums made of breakfast food boxes are used with great effect. March records are also used for the regulation marching, the "Teddy Bears' Picnic" being used for walking with arms and knees bent in what the children conceive to be a Teddy Bear manner. The other rhythms are used for characteristic activities suggested by the music, such as running like reindeer, stepping high like horses, skating, and rowing.

The children show very little spontaneous response to these rhythms. When a record is played and the children are told to "do as the music says," or "do whatever you want to," they are as likely to go and play on the slide or fill sand bottles as anything else. If the teacher suggests or enacts some appropriate dancing or skipping response, the children enter into the activity with apparent pleasure. Having a copy to follow, an idea as it were, seems to remove the self-conscious tension, which a desire to response and the lack of a definite mode of response sets up in them. One small girl who had had two or three dancing lessons from a young aunt often asked to be allowed to dance to a favorite piece of music, fitting her whirling and skipping rather nicely to the theme of the music. The other children, inspired by her example, would turn round and round, but usually in very poor time and with little regard for the music. It seemed to be mere physical activity and very little dancing. This does not mean that the children are unresponsive, but simply not creative or original.

Games.—The folk dance music is always enjoyed, but only the simplest dance figures can be executed. Making a bow to one's partner, grasping hands and swinging in a circle, stamping and clapping hands are about the limit of the little children's performance. The singing games are better suited to the children's stage of development, although in all songs the tempo must be very slow for young children. Material for these games will be found in the books listed in Appendix IV. The educational departments of almost all the phonograph companies publish booklets of suggestions on the use of various records in the earlier years of a child's life.

Æsthetic Experience

Æsthetic experience is less subject to conscious control than many other phases of the educational work. Every effort has been made to have the group room a beautiful place with attractive furnishings, pictures, plants, and flower bowls. The morning talk frequently takes as its point of departure a picture or some beautiful object. The children are encouraged to think of the æsthetic quality of any coloring they are attempting (Fig. 53). It is surprising to see how much pleasure the children take in each other's pretty dresses, and this furnishes an excellent motive for a discussion of harmonious colors, matching shades, and so

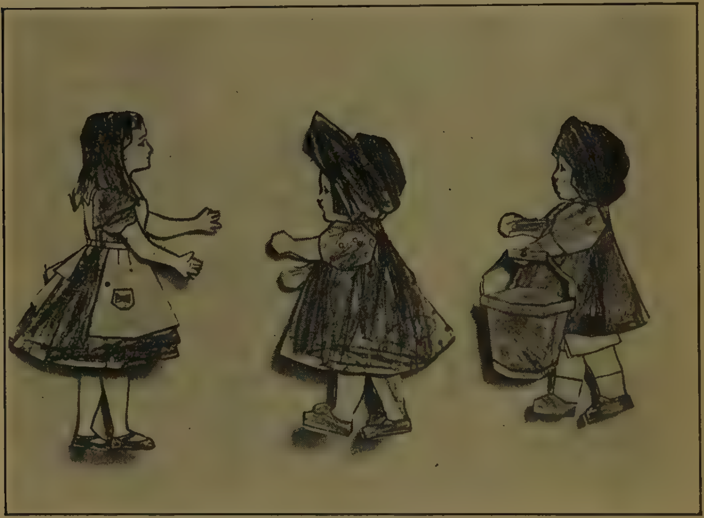

FIG. 53. FIRST ATTEMPTS AT ART.

forth. Occasional work in drawing and clay working prepares for the more formal lessons of the junior primary.

Constructive Activities

Making Room Decorations and Conveniences.—Several times a week some decorative project is undertaken. For example, during the autumn days this consists of copying pumpkins the children bring to the laboratory, and using the cut-out crayon-colored products to decorate the group room. Again in the spring the bird series of the cut-outs, used in connection with nature talks, forms an interesting new spring decoration for the group room windows.

Nailing and painting a window box occupies many mornings. So far as possible the children do the actual work themselves. It is remarkable how few hurt fingers and paint-stained dresses result.

The making of scrap books as permanent material for the entertainment of the group in leisure moments furnishes another way of linking up the morning conversation with constructive activities. The children are occupied for some time in making a picture-book house. They choose a room to furnish, talk about the various things that are found in the kitchen, and cut out of magazines suitable pictures, voting on the best pictures to paste on the kitchen page. All this cut-out and paper work must be carefully managed so that it is never merely an exercise in "cutting out," but is a process of making an object for some definite and conscious use.

Household and Community Tasks.—The daily tasks of dusting and of caring for the plants and pets are performed at the suggestion of the teacher. Cleaning up the floor after some handiwork is also performed with surprising proficiency. Arranging the tables for the milk lunch, carrying in the bottles, and washing the empty bottles are all done by the children themselves. Many of the children have never before been allowed to carry a full bottle, so all the more care is exercised in order to get the full half pint to the table. Making and serving cocoa for a "tea party" furnishes further training along motor as well as social lines. The washing of dishes and of tea towels that follows is as much a part of the fun as the party.

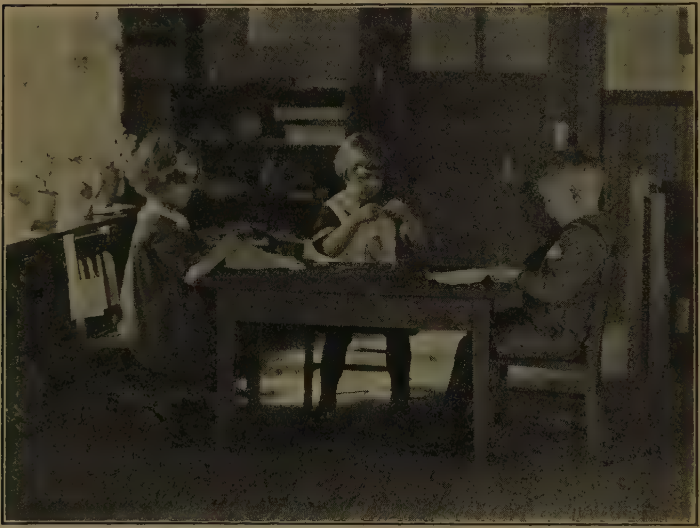

Fig. 54. MAKING DOLL DRESSES.

The doll house is the center of group activities for many weeks while it is being furnished. Pasteboard furniture from the Milton Bradley set is cut out, colored with crayons, and shellacked. Wall paper, some of it hand-colored, is pasted up in each room. The floor coverings are paper mats. Curtains and decorative objects follow. The inhabitants of the house are paper dolls and small dolls brought to visit from home.

A more elaborate project is the making of dresses for the laboratory doll (Fig. 54). The teacher cuts from paper a simple kimono pattern which the children then pin to the cloth and cut out. The children usually have to be shown how to make stitches, but after several days the dress begins to take shape. The boys are just as enthusiastic as the girls. One boy three and a half years old invented a way of "overhanding" the seams instead of doing the regular sewing stitch. In about a month's time the doll usually has half a dozen dresses.

The construction of miniature towns, gardens, and the like is always interesting to children. A project of this sort is the construction of a dairy farm. The sand tray, which can be rolled out on the floor where every one can sit or kneel while working, provides the ground for the farm. A herd of realistically painted tin cows and calves, and paper farm buildings constructed by the children provide all the equipment that is necessary for dramatizing the daily activities of the farm. A baking-dish lake on which floats a celluloid duck is very stimulating to the imagination of small bridge builders. Trees are easily made of sticks topped by bits of sponge dipped in green ink.

The construction of a play house from the large floor blocks is undertaken many times during the year. At first it requires considerable help from the teacher to carry this to a successful conclusion, not because the children lack the ability to do the work, but rather because they need stimulation to sustained effort. To make the house, four heavy blocks are set upright on their square bases to form the corners. Into grooves in these slide the long flat pieces to make the sides of the house. Windows can be arranged with shorter boards. The completed house holds six or seven of our small children. After the children have been shown how to build the house, they often add embellishments in the way of board walks and a square pen for a porch. Upon the suggestion of a boy of unusual initiative, the children one year worked together to build

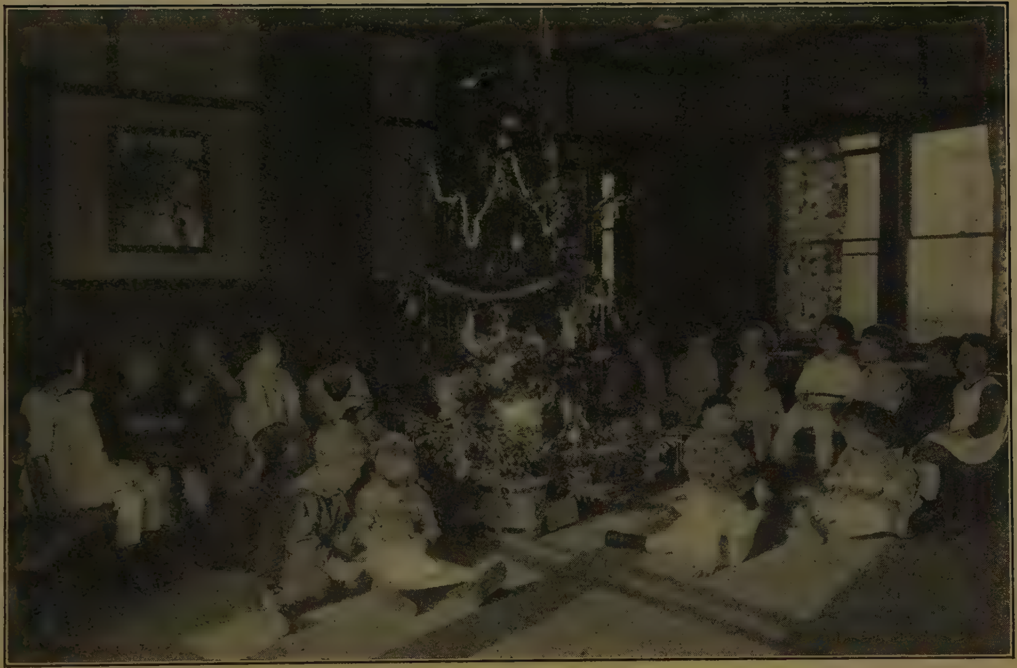

FIG. 55. THE CHRISTMAS TREE IS A GROUP PROJECT

a "movie-house," where this child gave a performance with slips of pictures drawn behind a square opening, material which he had cut from a magazine.

The construction of the cart from the long boards, the pipe, and the wheel-like blocks provided with the set is an interesting project because it affords a useful product upon which the children can give each other rides or transport objects to other parts of the room. Several times the cart has served to bring back materials borrowed from the junior primary or to carry a basin of turtles that has gone the rounds of the elementary schoolrooms.

Preparing for Festivals and Parties.—Every holiday is observed with some characteristic activity. Among the more elaborate of these occupations is the decoration of the Christmas tree and the giving of a Christmas party (Fig. 55).

Early in December the children begin the popping of quantities of corn. As far as possible the children themselves carry out all the operations of lighting the gas and shaking the iron skillet in which the corn is popped. When a great basin full of popped corn is ready, the children set to work at stringing it. Each string is marked with its owner's name, so that each child has the pleasure of adding to its own string day by day. The children work at this with real interest for many days, comparing the lengths of the strings at the end of each day. A week before Christmas the tree appears, and much time is spent hanging up one's own string or strings, in such a position as to decorate the tree while exhibiting the string to the best advantage. Then begins the stringing of cranberries, with all the attendant difficulty of not "squashing" the berries and staining clothes. These, too, are hung by the children, so that the tree has a very real and personal meaning to each child, and is exhibited with individual pride to visiting parents. Paper chains, lanterns, clay ornaments, painted and gilded, and stars are also made. An expedition is made to the room of the junior primary children to invite them to a Christmas party. The children then make and decorate pasteboard boxes which are later filled with candy and presented to the guests. Each child also makes one or more Christmas presents for the family. Some years these gifts are tin cans painted black and stenciled in a color, a calendar, or various objects modeled in clay.

One of the most successful projects from the point of view of interesting the children year after year is the coloring of Easter eggs. For some time before Easter, the children spend their conversation period discussing the various reasons why we enjoy Easter—the returning of flowers and birds, the warm days, and then the Easter rabbit make-believe. It is decided to make a big nest and fill it with Easter eggs. For days the children work with great enjoyment cutting colored tissue paper into long grass-like bits to fill the wire nest. Children who have formerly found the use of scissors very tiresome are eager to work up to the very last minute. The nest with a plaster Easter rabbit that fortunately appears at this time is set in a conspicuous corner of the group room.

On the day for coloring the eggs each child puts its egg into a kettle of water boiling on the gas. Then bits of colored dye paper are cut into a cup by the child while the eggs and water for the dye are boiling. The cup is filled with boiling water and the color stirred out of the paper with small sticks. Each child dips an egg into a color cup, turning and watching it until the shade is satisfactory. After the eggs are dry they are polished with olive oil and ceremoniously placed in the nest for the Easter rabbit. A number of children bring some cherished pre-Easter gift, a chick or a painted egg, to add to the collection. The project occupies about two weeks.

Other holidays and festivals have contributed their own atmosphere to less elaborate projects, such as making Hallowe'en plates for a party, valentines, George Washington cherry trees, and celebrating birthdays with sand cakes on which are placed lighted candles.

Occupations for the Older Child

The junior primary activities are described under the same head as were those of the two younger groups. In addition to the greater complexity of the occupations for the more mature group the introduction of some new activities will be noted.

Language

Literary Appreciation.—Children of junior primary age enjoy having stories and verse read to them. The children are encouraged to retell any story during the conversation period or to tell a story of their own. A list of books containing suitable material is given in Appendix I. This includes a reference to a selected list of books and stories for children in kindergarten and the early grades published by the International Kindergarten Union.

Dramatic Play.—Stories they have heard or incidents from real life are frequently dramatized by the children, part acting as audience while the rest put on a "show."

Reading.—Almost all children come to school with the idea that they are "going to learn to read." In order to satisfy this interest a few flash cards are used in the early part of the year so that the children become familiar with the manuscript printed form of such words as names, the various parts of the body, and simple directions—"Erase the board," "Shut the door," "Water the plants." The children form the habit of looking on the bulletin board each morning to see the names of the monitors for the day and to note their duties. Gradually other interests come in and it is possible to postpone the formal work in reading until the children have had more general social and motor experience.

After Christmas the material developed in the Detroit public schools for the teaching of reading is introduced. The following description of the tests is taken from the directions for the use of the material.

> The Courtis Standard Practice Tests in reading consist of material out of which the child can build pictures. There are a series of picture frames and a corresponding series of printed figures to be cut out, colored, and pasted on the frame to make the completed pictures.
>
> To guide the child in making his pictures, a series of printed directions has been prepared. The first picture is very simple and is constructed from the oral directions or by imitation. But as soon as the general idea of the method is understood, each child is given very simple printed directions, each word of which is illustrated by pictures in such a way that it is possible for the child to teach himself the one or two new words needed to understand the directions.
>
> As each child completes his pictures from directions he compares it with the Standard picture. If he has not followed directions exactly, he is self-convicted and must repeat his work as a penalty until he reads aright. Upon attaining success, his growth in power is tested by giving him a story about the picture which he can read to himself and others. These stories are printed on loose leaf pages which, one by one, he fastens into the cover of *My Story Book*, thus building up from his own work his first primer.

The work in reading is begun by checking up on the words the children have already learned at home or at school. Then the supplementary practice material is given them, as specified in the directions, taking from two to four or five days, according to the ability of the various children. After this they are ready to begin on the lessons proper. For the thirty-eight words contained in the course and not included in the dictionary a chart is made, and it is understood by the children that any word on this chart will be told them by the teacher; otherwise, it will be found in their dictionary. As soon as each child finishes one lesson (Fig. 56), and has studied the reading story belonging to it, the teacher checks up on the story vocabulary, thus determining whether or not the child is ready for the following lesson. In this way, each child advances at its own speed. A chart showing in tangible form the progress of each child is made and marked by the child upon the completion of the checking with the teacher.

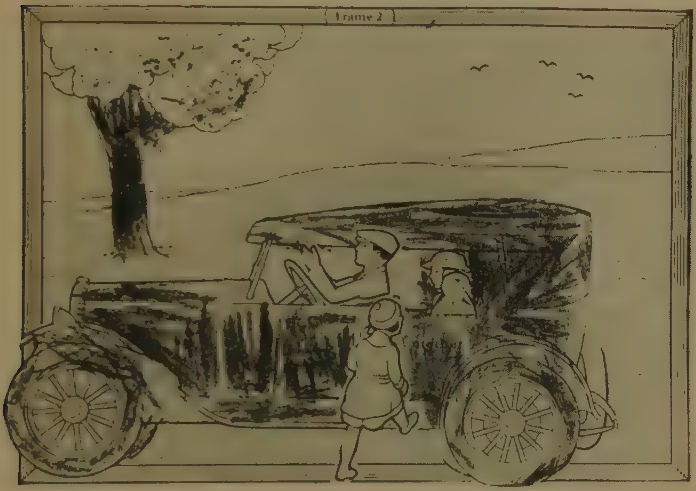

FIG. 56. BY-PRODUCT OF THE READING LESSON.

Seventeen of twenty children had completed their story books by the end of three months. Three others, who were slightly below average intelligence, about 85 I. Q., got only to the third or fourth lesson. The first child to finish without any help at home was the daughter of a little grocer. Her I. Q. was 144. A check with the entire list of words used in the material showed, however, that even after a child had completed its story book it often did not know the words isolated from their context. The experiment is being continued during 1924 with a new group of children. Flash cards are being used for drill on words that need special attention.

One of the advantages of the method is that the child from the first realizes that it is getting information from the printed page. Then, too, it is getting its reading in content form rather than in isolated words or phrases. The greatest advantage is probably that the child with a little supervision really teaches itself and consequently gains the power to acquire knowledge through its own efforts.

In general, the handwork combined with the reading appeals to the manipulative interests of young children, although for some the reading is of such interest and importance that they do not care to be bothered with the cutting, coloring, and pasting.

The method is very good for a small group, if one wishes to use a semi-formal presentation, but less feasible for use with a large group because of the checking up on the vocabulary necessary after each lesson. The expense of the set of material might also prove to be an obstacle to general use.

Writing.—Late in the fall of 1923, writing was begun as an experiment in the method of teaching recommended by Freeman.[45] The writing materials consisted of large size beginners' pencils and eggshell scrap paper 6 by 9 inches, ruled an inch apart on both sides by being run through a mimeograph. Informal tests were given to determine the status of each child in regard to position and grasp of the pencil and general movement. The majority of the children were found to have a cramped hand position, with the hand turned too much to the right, and to show very unrhythmical writing movements. Accordingly about forty minutes distributed throughout the week was given to writing practice. General instruction was given in holding the pencil and in performing simple exercises, such as are recommended by Freeman, making large circles, continuous half circles, continuous scrolls within the lines, u-like figures, and so forth. It must be remembered that this was done merely as an experiment in teaching position and not because this was believed to be the most efficient method of teaching writing.

In the first attempts very poor control was manifested by the majority, both in imitative movements and spacing. For the first few weeks little general improvement was noticeable, although in individual cases big gains were made, so that several children were allowed to start on words earlier than the rest. This appeared to spur on the others in their attempts at correct position, for by the end of the first month all were writing simple words, such as see, men, ball, cat, with a rather uncramped movement. As soon as the child and teacher had decided that a word was sufficiently well written, the child was given a new one. Later several words could be done in one day, according to an assignment written on the board.

The children became so much interested in the writing that they often used their free time for writing at the board or at their desks. Their writing papers, which at first they labeled by printing their names, by the end of the first month bore written names and dates. Every picture drawn in the art work was labeled. One boy wrote "fire," "ladder," "man," "hat," and "hose" on his picture drawn to illustrate a visit to the fire engine house. At Christmas time most of the greeting cards were written, only the slowest children using printing. At Easter time all the children wrote invitations to an Easter party.

One of the most intelligent of the children, just prior to Easter, wrote an original story about the birds and their nests. This unusual attempt was traced to her extreme interest in the Courtis reading material, which was supplying her, in the dictionary, not only the printed word but also the written form. The other children were all immediately inspired to write a story, too, and overcame many obstacles in the way of new combinations of letters and in the choice of words. Some took a story book and copied from this. Others wrote nursery rimes they knew, asking about words they could not spell. All but one wrote along in a line, not indenting, punctuating, or capitalizing, since this had not been taught. This one child copied the lengths of sentences from a book. It was apparent that the children would have enjoyed spending a great deal more time in writing and that the extension of the original work would necessitate much more time because of the new words constantly being introduced. Other methods of teaching writing are being tried out this year. Similar experimental work in reading and writing done by A. I. Gates and others is reported in the *Teachers College Record,* 1923, vol. 24, pp. 459-488.

Nature Experience

Nature Talks and Experiments.—The group discussions of seed pods, shells, nests, and other nature material are much more detailed and better organized than with the two younger groups. Observation of the living plants stimulates the desire to experiment with growing things. Sand is mixed with the soil as the children have seen done in the greenhouse and seeds are planted—cucumber, nasturtium, corn, barley, and lima beans. Some seeds are placed on wet absorbent paper and covered with glass jars. The differences in development are noted and the growth traced by charting and drawing the size at various dates.

Crayfish, caterpillars, snails, turtles, and toads are brought in by the children and studied with reference to habits, food, locomotion, and protection of young. Animal pictures provoke similar discussions. Each spring a setting hen has been brought with eggs from which chicks eventually hatch. A bat which was found in the schoolroom one morning was watched in its cage for several weeks.

Weather observations lead on to the discussion of facts in regard to the seasons, the movements of the sun and stars, and similar natural phenomena.

Excursions.—Much more information is brought back from greenhouses and museum trips than is possible for the younger children. Interest grows in the classification of natural history material and the development of a schoolroom museum.

During one of the nature talks, the question is brought up as to the proper kind of earth for the new window boxes. The fourth grade room is visited for the purpose of finding out the results of an experiment these children make with various kinds of soils. An expedition is then made in search of good black earth. The little group, provided with a cart, shovels, and trowels, stops many times to examine dirt of various colors, to notice the shape of the hillsides and the effect of recent rains, and to collect pebbles and other specimens to take back to school.

Observation of the fossils, in which the region around Iowa City is very rich, results in the children's learning much about bygone ages. While watching the muddy Iowa River, the children become interested in the dirt in it, where it comes from, and what finally happens to it. The springs near the river, the wells for drinking water, and the dam near the school all come in for their share of attention. Discussion of these arrangements brings out many facts in regard to what works our electric lights and our water faucets. The result is a much better understanding of the environment than is usual in children of this age.

Many expeditions result from the nature talks. Interest in the subject of fire as useful to man and as a destructive agency and dramatization of activities connected with fire usually lead to a desire to see the city fire department.

Once a year, through the kindly coöperation of the chief, the children have the experience of calling the proper telephone number, of hearing and seeing the alarm notify the firemen, of watching the men come whizzing down the shiny pole from their quarters above, and of seeing them get out the motor and the horse-drawn trucks.

Physical Education

During the daily outdoor play period the junior primary children show much more ability to play group games than the younger children. They still enjoy hoop rolling and jumping the rope, but take less pleasure in these purely individual games, preferring to have group play with a ball, tossing and bouncing it from one to another without supervision. Their growth is shown also in the development of a keen sense of rivalry, as revealed in games such as "Going to Jerusalem" and in races.

The singing games of the earlier days, while still popular, gradually give way to games of somewhat higher organization, like "Cat and Mouse," "Drop the Handkerchief," and "Pussy Wants a Corner."

Toward the end of the year the group becomes interested in organizing a track meet and practicing diligently such activities as the running and standing broad jump and high jump, the tug-of-war, and relay races.

Musical Experience and Training

Children always enjoy listening to a phonograph, especially if there is the added satisfaction of the instinctive tendency "to do something and have something result" which comes from being allowed to operate the machine. From mere listening, the children are led on to active appreciation and analysis of good music.

Singing also arises spontaneously, first as individual attempts to follow the phonograph songs and then as group singing. Several days a week a singing period is supervised by a special teacher who accompanies the children on the piano. As with the younger groups, the compositions with decided rhythms are used for characteristic activities, skating, swinging, rocking, and so forth. These older children seem to understand better what the music suggests and show more originality than the younger children in fitting action to the music. Their attempts to beat time are also much more successful, and even the more complicated rhythms are accurately marked. They have organized a band with simple instruments made at school or brought from home and have a great deal of pleasure from the feeling of sharing in organized group activity.

Æsthetic Experience

In addition to the conversations about beautiful objects and the attempts at room decoration, which are more extensive than with the less mature groups, the junior primary enjoys more formal instruction in art. The first few lessons are spent on color. The children's knowledge of color names is checked by means of crêpe paper. They are then allowed to place together papers of different colors and to discuss the æsthetic value of the resulting combinations with a view to developing some taste for harmonious effects. The secondary colors are studied in order to find out how they are formed.

The study of proportion is begun by showing the children marbles of various sizes and having them model marbles of the same size. First the children are shown a large and a small marble, which differ greatly in size. Gradually the sample marbles are brought nearer together in size as the eye is trained to see smaller differences. The proportions of pitchers, vases, and other objects with simple lines are discussed. The children are trained, for example, to observe the size of a handle in relation to the whole jug, to

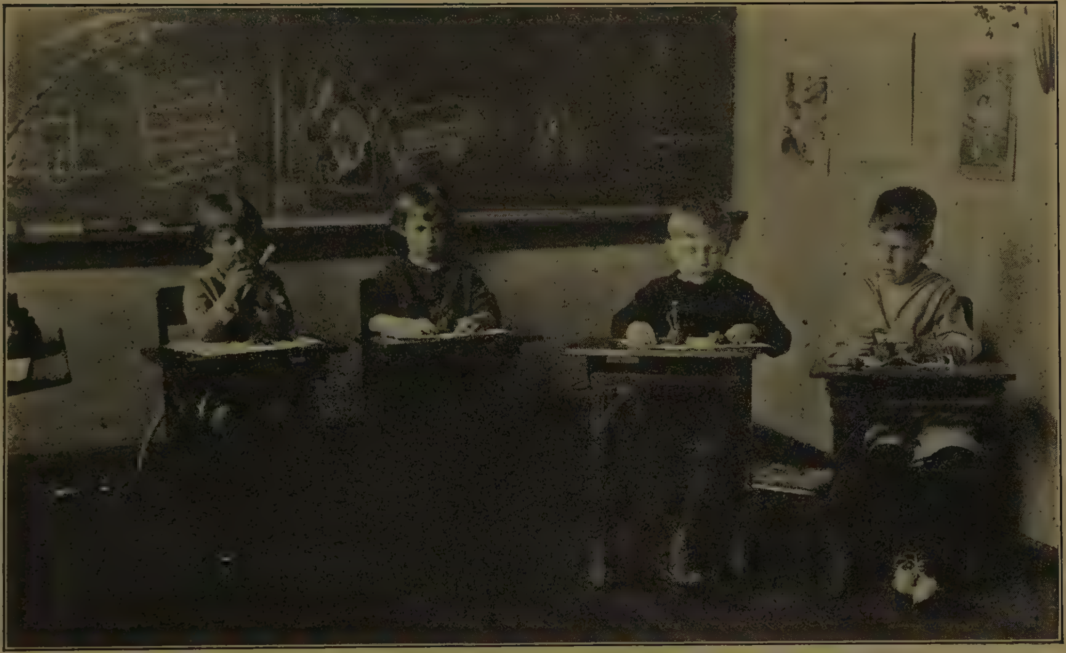

FIG. 57. CLAY MODELING IN THE JUNIOR PRIMARY LABORATORY.

note the length of the spout, to see that the two sides of the object are equally curved, and to realize that the base is larger than the top. They are then ready to begin modeling the object in clay (Fig. 57), appreciating in that way not only the general outline but also the thickness. This should always be the order of presentation in work with small children whose spatial concepts are as yet too poorly developed for an outline to be really representative of the object.

After the children have gained some control in modeling something that resembles the real object, they are allowed to work out their own ideas in free modeling periods. A number of interesting things have been created by the children, from a cart and an airplane to a crucifix which was made by a very artistic child who had been much impressed by some sculpture it had seen.

The work in drawing is preceded by picture study, in which the idea of perspective is developed. After a discussion of the lines and proportions of some object, the children draw it with large crayons. Later, colored crayons are used to make the drawing of a bowl more realistic and to convey the beauty of flowers or leaves it contains.

The skill gained in the art periods is applied in various projects such as making and decorating a folder to hold each child's drawings, making Christmas calendars and blotter pads decorated with an outline drawing of a candlestick or a holly sprig, modeling and painting a clay candlestick for a Christmas gift to the family, and making valentines. The children also make various things for an Easter party, such as invitations decorated with a sketch, cut out and colored, of a rabbit, cardboard baskets to hold eggs, and paper napkins with appropriate designs drawn in crayon.

Perhaps the largest gain from the art instruction is the ability to illustrate group experiences. The children frequently coöperate in making a large drawing at an art desk

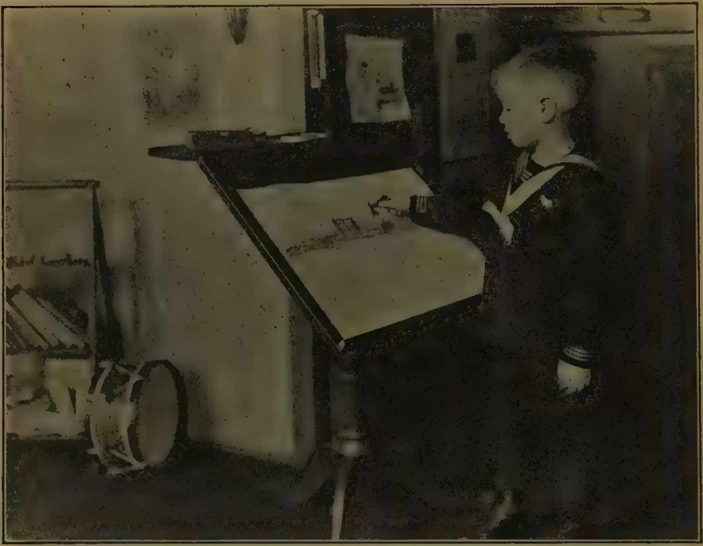

FIG. 58. ILLUSTRATING FOR THE CLASS.

set up before the group (Fig. 58). The actual drawing is done by two or three children, but suggestions are made by all. Such a group production probably results in a very real increase in power to profit by suggestions, and to become conscious of matters of technic.

Constructive Activities

In connection with the constructive activities of the junior primary a beginning is made of the study of number. Measuring and cutting materials, counting supplies, and checking the attendance of the group lay the foundation for the more formal number work of the first grade.

Making Room Decorations and Conveniences.—Attempts at beautifying the group room are much more elaborate and consistent than in the case of the younger children. All the special holidays are observed with appropriate decorations. At Christmas time especially elaborate decorations are undertaken for the tree. A fireplace is constructed to give the real Christmas atmosphere; the children plan it, get the lumber, saw, and nail it. One little girl once suggested thumb tacks as a means of fastening the red-brick paper to the boards. Splashes of fire color on the black fire box and red tissue paper between the logs make it look even more realistic. Many dramatic plays take place with the tree and fireplace for a setting.

One of the first projects in construction in the junior primary was a bag for holding the dust cloth; it was measured, cut, sewed, and strung by the children. The room bulletin board of cork linoleum framed in pine was made one year by the older boys of the University Observational School, but the staining and hanging of the board were done by the junior primary children. The cruder carpentry of these younger children suffices for the making of window boxes which they also paint.

It was evident early in 1923 that a large rug on which every one could sit during the story hour would be a great convenience. Each child accordingly made a loom 10 by 14 inches from four pieces of wood. Heavy wires on the longer sides were held in place by staples. Shingle nails were driven in slantwise at regular intervals to serve as posts over which the woof threads were stretched. The cutting of the cloth into inch strips and the sewing or splicing of these strips into yard lengths followed. When the looms were completed, the children wove the rags over and under the strings with their fingers, finally sewing together the small rugs into the large one for group use. They demonstrated the whole process to the school assembly of about 200 children, explaining the demonstration by the words given in the following stenographic report:

THOMAS. "The first on our program. . . .
Our program is in two parts."

FRANK. "We will tell you how we make our looms. Jack will show you how to make our looms." [Jack and Sam demonstrate with pieces of the loom and try to hold them together properly.]

JACK. "That's how they look."

SAM. "Say it loud!"

JACK [still working with the pieces].
"Way up like that . . . let me see . . . there, that's how it looks, but the pieces are somewhat crooked. We keep them straight, though. See, now this is s'posed to be back like that."

SAM. "Here, take this up!"

JACK. "All right, we will pretty soon. [Holding the loom up for the audience to see.] That's how they look. We keep them straight because we want them to look like that. [Speaking to MARK.] Here, take this one now. Now you go back and I'll finish this. [Again holding the loom to the audience.] That's how it looks before the nails are put in. Now Fred is going to tell you how it looks when it is finished."

FRED. "Then pound the nails in straight and put them back that way, so that the thread will stay on. Put it clear across here. Arthur will tell you how it looks when we put the cloth on."

ARTHUR. "This is the way it looks. The strips are strung back and forth and they are not over one nail but over two, because we want to make it wider and it looks better that way. You go over one and under one and try not to make mistakes because it looks better. There are a few mistakes in this one, right across here. Jack will tell you about shuttles."

JACK. "We use our fingers for weaving. Big people use shuttles, but we use our fingers and this is the way we do it. [Demonstration.] This is the way it looks. Florence will tell you how it looks when it is done."

FLORENCE. "This is the way it looks when it is this far done. [Holds up the partially finished rug.] Donald will tell you how. . . . [Hesitates a short while.] Donald will tell you . . . now."

DONALD. "I will tell you how to take it off of the loom. You take the warp threads off of there and take the wire out, and then tie the woof threads like that. [Demonstrating.] Clara will tell you about the rugs."

CLARA. "This is what the rug looks like when it has *came* off of the loom. Now Billy will tell you something else."

BILLY. "This is the way it is made. You tie it together right here. [Demonstrating.] Now Janet will come up and tell you how it is sewed together."

JANET. "This is the way the rug looks when it is sewed together. We sew over and over, going down towards the bottom and we try to keep it even. We put beeswax on the thread to make it strong. We will have about twenty more when we get our rugs all finished."

[In answer to a suggestion from the teacher to show a certain rug, Janet picked it up and held it before the audience.]

"I don't know what to say, so guess I'll let it alone."

Performing Household and Community Tasks.—The necessary housekeeping chores can be entrusted to these older children who accept the responsibility with only a slight reminder from the bulletin board.

Each fall the making of jelly is one project that results from conversations about storing food for winter use. Apples are washed, peeled, cored, and sliced. Water and apples then have to be measured, the cooking timed, and the straining done. The next day sugar in the required amount is added, cooking again timed, and the hot liquid poured into the washed glasses. No housekeeper ever waits more anxiously for the morning to see whether the jelly has "jelled." Melted paraffin is poured on the jelly and labels are pasted on the glasses. The glass of jelly each child takes home and the glasses sent as a present to the Children's Hospital have a very real meaning, since the children themselves have done the work and taken the responsibility for the measuring and timing.

Another worthwhile activity consists in attending to the laundering of Mary Jane's clothes. This doll always goes to assembly and on excursions with the group. Boys and girls together see that her clothes and the linen on her bed are washed, dried, sprinkled, and ironed.

Preparing for Festivals and Parties.—Many small festivities are organized and carried through by the children. The most elaborate of these is the Easter party which requires much preliminary work and includes the presentation of a program for the entertainment of the guests and the serving of milk and sandwiches.

The "open house," which always closes the school year, furnishes another occasion for coöperative activity in preparing and placing an exhibit explaining the work of the year to the parents, and in serving tea to visitors. The fact that the children are successful in such an ambitious undertaking is testimony to the benefits derived from group activity, even by young children who are considered in the average home to be unable to accept any responsibility.

CHAPTER XI

SOCIAL DEVELOPMENT

Psychological Background and Its Effect on Character

THE influences that operate on the child in its early years have probably given a permanent set to its character and disposition by the time it is of preschool age. In order to exemplify some of the influences that operate on the preschool child, the following individual sketches of some outstanding children in the preschool laboratories are given. The sociological data upon which these sketches are based were collected by the teacher, a social worker trained in family case work, in visits to the home of each child, and conferences with the parents. A copy of the blank used is given in Appendix VII. The sketches also incorporate the results of physical and psychological measurements and the character descriptions written by each of the six adults who came in contact with the children in the laboratory:

CHILD 1

Mollie was three years one month old at the time she entered the laboratory. She was a well-built child whose height was that of the average child five months older. Her weight was 2 pounds greater than the average for that height.

The first general intelligence examination showed an I.Q. of 110. This seemed to represent her mental status, as she was well adjusted to the situation and spoke fluently. The other psychological examinations agreed fairly well with this one, showing Mollie to have good average ability. She seemed to realize her inadequacies in some situations and always rationalized her failures, saying, for example, "You come to my house and I'll do it for you."

The examiners agreed in calling Mollie "affectionate," "sensitive," "shy," and "sympathetic." Her position in the group was never conspicuous, nor did she ever assume leadership in any way. Her predominating attitude was a protective, maternal one. Whenever a child cried, Mollie was sure to be somewhere near to offer comfort, or at least to watch the proceedings with a sorrowful air. The other children never singled her out for special attention in any way. Toward the teachers, her attitude was a constant appeal for pity or favorable notice, and any shadow of blame completely overcame her.

Mollie was the second child of middle-aged parents who had both been successful in administrative capacities. Her sister, several years older, treated her like an animated doll. The home was unusually comfortable with a well-equipped children's room. Nevertheless the parents reported that the children were obstinate and difficult to handle. Mollie showed evidence of many complexes. She was very much afraid of the physical measurements and of the school nurse's inspection and she gave the impression of having been frightened into obedience at home.

Child 2

Frank entered the laboratory at the age of two years and two months. His height was that of the average child three months older and his weight was 2 pounds more than the average for that height.

Frank impressed one as being intellectually superior. Because of his extreme shyness and the difficulty of getting him to fall in with any plan not of his own invention the two general intelligence ratings, I.Q. 111 and 110, probably did not represent his real ability. In the special psychological tests also he did only about the same as other children of his age.

Frank was an individualist. His position in the group of children was that of an observer. He much preferred the company of adults and would usually ask some one to read a book with him instead of playing with the children. Even in this association with adults he maintained considerable independence, persisting in some plan of his own despite every effort to distract his attention. It was always difficult to get his coöperation in any psychological test, since he usually had some original way of using the material.

His motor control was poor, and he often lost his balance.

His movements were slow and he was rather inactive at an age when children are almost constantly in motion. The father was a college professor, the mother a student for a higher degree. The home was very attractively furnished, with a model play room for this only child. Frank had always received a great deal of attention from his parents. They recorded his vocabulary very carefully for the first two years. Many stories were read to him, and an effort was made to have him hear much good music on the phonograph and at concerts. He already knew the names of an astonishing number of compositions. The child had a very attractive personality, but was in danger of developing an abnormal attitude because of too much adult attention.

CHILD 3

Sara at three years five months was as tall as the average girl seven months older and almost 2 pounds heavier than the average for that height.

She impressed an observer at once as being of very superior intelligence; her average I.Q. on four examinations was 143.5. She was self-possessed and spoke distinctly and fluently when she knew what to say, but lapsed into an obstinate, puzzled silence when things did not go well. She was superior to children of her age in the performance of most psychological tests.

Sara was an exceptionally beautiful child, who went about with a very earnest and grown-up air, taking even the most casual errand or responsibility with disproportionate seriousness. She was extremely persistent in any activity she undertook. She called attention to herself and her doings very frequently, even in the face of adult disapproval. Sara did not care much for group play, but would sit rocking a doll and looking on at the others. The only social game that seemed to interest her was one in which she could lead, as in playing house or school, when she would "mother" or "teacher" the other children with real enjoyment. Sara had always lived in the public view with a great many adults coming and going in the home. Her parents were earnest, religious people who were devoted to Sara and unaware of the fact that she was becoming rather "smarty." Sara had little contact with her brother several years older, but mothered her younger sister and sometimes brought her to the laboratory to show her off.

CHILD 4

Sylvia came to the laboratory at the age of three years three months. Physically she belonged to the short type. She was only as tall as the average child six months younger and about 1 pound under weight for that height.

Two general intelligence examinations showed her to be of about average ability. She was a very self-possessed young person with excellent motor coördination and consequently she did better on the special psychological tests than many children of her age. Sylvia was a quiet, reserved, almost "mouse-like" little girl, with a great deal of self-sufficiency. She was obedient, but inclined to "pout" and "sulk" if she did not have her way. She came very near being a leader in the group, for she was helpful with the quieter children and yet played well with the more active ones.

The father was a retired farmer. The home was well furnished, clean, and neat. Sylvia was next to the youngest of seven children and had many cousins who added to the "houseful" with whom she usually played. Her mother reported that she was "good natured" and had been "imposed" on by her little brother, hardly a year younger, but bigger than she was. Sylvia had been rather deprived of "babying."

CHILD 5

Albert at three years three months had the average height of a child four months younger and weighed 2 pounds less than he should for this height.

The first general intelligence examination gave a rating of only average ability, but after three months Albert had developed a great deal, obtaining an I.Q. above 120. He was a stable, well-controlled worker in all psychological tests and on that account often surpassed other children of his age.

Albert was uniformly described as a "serious," "self-contained" little boy, who made up for physical smallness and delicacy by a blustering swagger whenever his position or strength was challenged. Otherwise, he worked with a "dogged persistence" once he made up his mind to a task. Toward most situations he was already critical. Although he was eager to play, his aggressively defensive attitude often drove children from him. In the group he was usually "in the game," but in some way gave the impression of not being "of the game."

Albert's parents were young people who were making a plucky fight to earn their way while the father went through school. Albert was outdoors with older boys a good deal. His mother reported him "not a cuddly baby." He met many adults, mostly men, in his mother's boarding house.

Child 6

Stephen was a beautiful well-developed boy four years old, of average height and weight.

Stephen was of superior general intelligence, averaging 124 I.Q. on four examinations. He had rather remarkable control of language and spoke with assurance. He was, however, very indifferent and refused to exert himself. His motor control was rather poor, so he often did less in psychological tests of this type than his general ability warranted.

Stephen was called "sophisticated," "indifferent," and very self-conscious, but not at all shy. He continually passed judgment on his own activity, and almost uniformly called it good. He was affectionate and responsive toward adults, and self-controlled in his behavior with the children. In the group, he was often a leader because of his organizing ability, but sometimes was unable to hold a group together because he asked for responses too controlled and complicated for the other children.

Stephen's father was a physician much away from home. There were no other children. The family lived in a downtown apartment, very comfortably furnished. The parents were very musical.

Child 7

Sophie was three years nine months old when she came to the laboratory. She was of average height but several pounds under the average weight.

She was probably the most gifted in general intelligence of all the children, averaging 152 I.Q. on four examinations. In all the other psychological tests she easily outdistanced the other children of her age and was of great value to the experimenters because of her ability to introspect and throw light on the process being studied.

Sophie was self-confident, but not conceited. She was overactive and nervously unstable and talked incessantly. The observers agreed in calling her "alert," "high-strung," "intense," "highly emotional," and "expressive." She had very wide emotional range, and her feelings were easily stimulated by stories or seemingly trivial incidents. She craved the approval of individuals, but was unwilling to accept a conspicuous position in the group. The impression she made was that of complete and almost painful "aliveness" to her environment, both social and physical.

The father was a professor in the University, and the mother had been a teacher before marriage. The home was an ordinary, comfortable, middle western one, with a well-equipped children's room.

At home Sophie was a comrade to her older brother, and was kindly but firmly treated by her parents. She had a rather rich environment, with not too much adult attention.

The Effect of Group Play

The whole laboratory situation is one that acts very favorably on the social development of the individual. For many children it is the first step in the direction of independence. One little girl, who was so shy that her mother had not been able to leave her during a waking hour of her two years, had a hard struggle, but after a few days began to enjoy herself. Thus a most unfortunate mental attitude was broken up before it had time to affect the child's whole point of view.

Children who have always been dressed like dolls and had everything done for them learn to help themselves. One child who reacted to every new toy or game by saying, "You make it work for me; you do it for me like father does," gradually developed such initiative that he is now always saying, "Let me do it myself." With such independence of action, increased motor control and manual dexterity are inevitable.

With a number of children rather serious complexes already formed at this early age yielded to wise treatment in the laboratory. One little girl, who had been very forcefully told by her mother that if she walked without her shoes on she would get nails in her feet, had built up an emotional resistance to removing her shoes in the laboratory examining room and could scarcely be persuaded during two months to take them off for the physical measurements. After she had learned that other children were being measured without their shoes the fear disappeared in this particular situation. A little boy who had had the exclusive care of his mother had developed such an emotional fixation upon her that he would suffer any inconvenience rather than allow himself to be taken to the toilet by any one else. A little girl was discovered to be looking forward with horrible dread to the coming of Santa Claus, who, she feared, would carry her off on account of small misdeeds. Such systems of emotionally toned ideas, which frequently cause unbelievable suffering to small children, are often best treated outside the family in a play group where the new interests the child is forming, and the wholesome freedom from emotional tension in the atmosphere, are an aid to mental hygiene.

On the other hand, group life limits individual freedom of expression. The child who has always had its own way finds that other children must be considered and almost without its knowledge begins to form habits of obedience in response to no other compulsion than the general feeling that ''we all do it that way.'' The child who never hangs up its clothes at home does not question whether it shall hang up wraps at school because ''everybody is doing it.'' The little girl whose mother reports that there is a scene every time the word ''nap'' is spoken, runs eagerly to her pen when ''it's time to lie down and listen to the music.'' Part of the reason things run so easily and smoothly in the preschool laboratories is that there is a simple schedule every child can understand, in which certain events recur in regular and orderly fashion, and there is never any question about what is going to happen. A little child forms habits very easily and loves the habits it has formed. Mothers would do well to accommodate themselves to this fact and let such events as bedtime and bathtime be so fixed that they are not changed for the convenience of adults and the mystification of children.

The best aid to the formation of good character traits is, of course, the power of social control. Children as a rule start out with a strong sense of personal ownership and only gradually come into the notion of group possession. From the notion of "my chair" develops the concept of "our chair" and "we must take turns." A crude sense of fair play is seen emerging, and public opinion forces even the more dominating individuals to allow every child its just rights. A number of the children feel a real responsibility for seeing that small regulations are obeyed and take it upon themselves to help enforce them. There is

FIG. 59. PLAYING STORE.

also a sense of responsibility for the safety of the younger members of the group. Perhaps the most interesting social effect of group play upon a child is the dawning perception of the fact that by coöperation more can be achieved and more interesting products made than by individual activity (Fig. 59). Three children can make a bigger barn than one, and if everybody helps, the room can be more quickly straightened up at going-home time.

Some Fundamental Social Attitudes

From the daily log for the first two groups a summary of some fundamental social attitudes of preschool children has been made under the direction of the writers by Ethel Verry,* research assistant in the Iowa Child Welfare Research Station. At first the play of children two to four years old appears to present simply a mass of unrelated incidents, but it soon becomes evident that many of the social contacts are repeated from day to day in somewhat varied but similar forms. A careful analysis of these forms shows five clearly differentiated types of social attitudes for the data included in this study: (1) treating playmates as objects; (2) assuming an adult attitude; (3) seeking attention; (4) "doing as the others do"; and (5) coöperating with the group. It is possible that a more detailed psychological analysis of these divisions would show common underlying causes. This five-fold classification distinguishes the immediate factors common to the experiences and dispositions of the children which determine certain more or less common modes of social behavior. The concrete expressions of these modes, such as the exact words used, or posture assumed, vary from child to child, and are, of course, explainable in the case of each individual child in terms of its individual history. Such a classification points out certain roughly uniform causes which result in distinguishable types of behavior when young children first become members of play groups.

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* Unpublished master's thesis on file in the Library of the State University of Iowa.

Treating Playmates as Objects

The tendency to treat other children as inanimate objects was found to be more prevalent among the younger members of the group. The children proceeded to examine and manipulate, even by means of prods or blows, these new and active objects, their playmates, apparently in no way recognizing them as personalities. To be sure, they learned rather rapidly that certain behavior brought responses from the new object, but even the older children often failed to attribute to their playmates feelings like their own. It was not unusual for a child to take a desired object out of another child's hand, and show pained surprise in look and voice when that child resisted, although resistance would have been its own response if the situation had been reversed.

Assuming an Adult Attitude

The children very commonly treated the members of their play group in a way that obviously duplicated the treatment they were used to receiving from adults. More or less consciously they ''played grown-up.'' One of the first social contacts, with many of the laboratory children, was that of patting and in other ways ''mothering'' their companions. This might take the form of approval, pity, or blame, but always put the children on two distinct planes, of adult and child. Later, and more actively, this attitude on the part of a child resulted in helping the other children, then in directing them. The children of the groups studied assumed the maternal attitude toward one another a great deal and later would very obviously copy the teacher's attitude to them in their attitude toward their playmates. This sometimes became a conscious game of "house" or "school," but was regularly present in all their play.

Seeking Attention

"Showing off" was one of the most frequent attitudes assumed by the children in their relations with adults. It varied from the direct bid for attention to all sorts of half-conscious appeals for recognition. The attempts to "show off" to the other children were much less frequent, perhaps because so little recognition or admiration was given by the children to their playmates. This tendency was often shown when the children brought toys to the laboratory. They seemed to get a very positive satisfaction from walking about the room with a balloon, or doll, followed by a troop of children shouting, "Let me have it." As soon as the attention of the group turned to other interests, the child would leave its toy and follow the group. The attitude of "showing off" seems to offer a rich field for study as it colors, modifies, and complicates almost every other reaction.

Doing as the Others Do

The explanation of this tendency probably lies partly in the naturally social or gregarious nature of children. Another cause may lie in the combination of the children's desire to be active, or doing something new, and their dependence on outside suggestion for finding interests and employment. The activities of other chidren offer the most fertile source of suggestions, since the patterns set are usually within the range of their own interests and abilities. Whatever the underlying cause, there was a marked tendency toward uniformity of action in the group, and in activities in which an adult first directed the uniform responses, children soon assumed a responsibility for seeing that their companions conformed.

There were, however, great individual differences in the strength and manifestations of this tendency. Some children seemed primarily concerned with their own behavior; others consistently expended a great deal of energy in seeing that all their playmates did the expected thing.

Coöperating with the Group

Activities involving coöperation were rare in the free play of the children from two to three years, but appeared more frequently with the second group. There seem to be the two distinct types of these more complex plays which demand continuous and reciprocal adjustment of responses. The simplest example of the first type is the incident in which one child approaches another and says "Boo." The other child answers "Boo" and waits with apparent pleasure for the repetition of the situation. In this case, the children alternate activity, and apparently consciously adjust their mental attitude to a "make believe," or playful basis. There is a simple pattern of activity which develops into the most complicated games as the comprehension of the children grows. The second type of coöperation, the working together toward some common end, involves some division of labor. Two children wish to build a train, and carry a board too heavy for one, by each grasping an end. This is very seldom accomplished without some degree of leadership. One child will be more conscious of the end projected or more eager for it and will tell the others what to do and how to do it, gaining helpers in proportion to the persistence and vigor of his efforts, and the appeal which the project makes to the other children. The social attitudes involved in this simple leadership are a combination of tendencies already mentioned. The leader uses the other children as material for his own purpose or in directing them assumes the air of an adult toward inferiors.

Comparison of Social Attitudes of First and Second Groups

The simple tendencies discovered in the reactions of the younger group persisted in those of the children three to four years of age. It was possible to find children treating their playmates as inanimate objects, using them as toys, and helping and directing them with an adult air. ''Showing off'' to one another was rather more marked than with the younger children, but there was less of the general conformity. The children, being more active and inventive, were less dependent on one another for the suggestion of something to do. The number and complexity of coöperative activities increased noticeably. Although the five basic attitudes persisted, they seldom appeared in simple situations, but were complex in expression, and broke up into a variety of sub-classes. Individual children could to some extent be characterized by the predominance of one or two of these attitudes over the others. The personalities of the children even at three to four years as judged by their social relations to their play group were extremely complex. It was possible to pick out characteristic types of response in each child, as was done in the personality sketches, but to group the children as social or unsocial, while still possible, would have been more difficult than with the younger children.

Expression of Social Attitudes in Daily Activities

The social development of the children is dramatically portrayed in the log taken by a member of the staff each day. Excerpts from this follow, chosen with especial reference to the changes in social attitude.

First Social Contacts

October 26 (*Group* 1). The children manifested great interest in the performances of each other in jumping over the candlestick in "Jack, jump over the candlestick." This was quite in contrast to their indifference to the accomplishments of others when they first entered the school.

October 16 (*Group* 1). Today Bessie seemed really conscious of the other children as "persons." During a free play period when slide, sand, beads, and blocks were being used intermittently by the various children, Bessie ran up to Delia, who stood alone watching, and took her hand. They went to the blocks, got down half a dozen small boards, and fell to building "pens," individually. Not a word was spoken. Bessie soon left and went to the corner where a child was laying a row of square beads on the floor. She picked up a bead and laid it on the end of his row, laughing, but he pushed it away, frowning at her and doubling up his fist as though to strike. Bessie picked up her bead and tried to put it on a string, but after failing on several attempts, went to the slide, carrying the bead in her hand. She climbed up the slide just as Jamie was sliding down, so she got to the top as he stood up at the bottom of the slope. Seeing him, she called "Jamie, Jamie, catch," and threw the bead down the slide. Jamie walked away, almost shyly, as soon as he heard his name and did not slide so long as Bessie was near the slide.

Treating Playmates as Objects

September 26 (*Group* 1). Tommy was carrying a block around the room. Accidentally meeting Anna, he raised the block and hit her on the shoulder, smiling as if it were a jolly game. While the teacher was comforting Anna, Tommy went up to another child and repeated the process with evident enjoyment. When the block was taken away from him he did not seem resentful nor did he seem to have any insight into his actions, but went merrily off to slide.

Assuming an Adult Attitude

November 23 (*Group* 1). In the free play, Susan drew up two chairs, got Bessie to sit down with her, put her arm around her, smoothed her hair, and generally mothered her.

December 21 (*Group* 2). Sara is so anxious for others to do things as she thinks they should be done that she is frequently impatient and interferes unnecessarily.

January 16 (*Group* 2). The children are developing many traits of self-help and of coöperative helpfulness. Nearly every child helps with taking off and putting on his wraps, especially in regard to buttoning or unbuttoning coats, taking off caps and rubbers. Some children nearly always help others. Elizabeth unbuttoned and took off another girl's leggings, on her own initiative, without suggestion of any sort. She imitated the actions of older persons in doing this, having the other girl sit on a chair while she pulled the leggings off.

JANUARY 16 (*Group* 1). Betty Ann ran and got the dustpan when she saw one of the teachers sweeping up some sand. She has done this on two occasions, holding the pan for the dirt each time. She also clears away milk bottles and cups after the midmorning lunch.

OCTOBER 17 (*Group* 1). When the children went to lie down one of the girls said, "Why doesn't he," pointing to Frank, "lie down?" The teacher, seeing justice in the question, asked Frank to lie down. He stubbornly sat in his pen. The teacher took him firmly in her arms and laid him down. The next day his mother reported the following incident as having occurred at home. Frank took his stuffed buffalo, made a pen of blocks about it and sat looking at it. He said "Lie down, Buff" several times, and then came to his mother, saying, "Buff, bad. Buff won't lie down." He went back to his buffalo and giving it a tap, knocked it over, saying again, "Lie down, Buff." Then he returned to his mother, saying, "Buff good. Buff lie down." He repeated this "play" several times. The next day at the laboratory he ran to his pen and lay down voluntarily. When his mother came for him he ran to her, calling joyously, "Frank lay down—yes, yes, yes." From that time on he seemed really to enjoy the rest period.

OCTOBER 20 (*Group* 2). Stephen and four other children were sliding. Presently they drew chairs up beside the slide and while one of the children was going down, the rest sat on the chairs and tapped the child as it slid by. Alice began to push the child who happened to be sliding. Stephen climbed down, and getting beside her, tried to pull her away from the slide, saying, "You can't play if you push." The children ran away, one at a time, to the sand or shelves. Stephen, left alone, began to arrange the chairs in a row in the middle of the floor. Apparently by accident the last chair in his row reached the foot of the slide, the seats of the chairs making a raised platform at right angles to the first step of the slide ladder. With a shout, Stephen ran to the first chair, walked upon the chair seats to the slide, jumped onto the slide ladder and went down the slide, then back to the first chair to repeat the process. After two trials, he called to two girls who were walking idly about, "Come and slide this way," showing them. They followed him at once. Lucy, absently wandering around, went to the slide and started to climb up. Stephen was already up on the top of the slide, but he climbed back, saying in his most firm and argumentative voice, "Not that way, Lucy; I want you to do it the way I do." He repeated this, but Lucy looked at him blankly. "I'll show you," and Stephen put his arm around Lucy's shoulder and led her to the end chair, explaining each step of the proceeding as he did it. When she followed him, he said, very much pleased, "Now, that's what I wanted you to do." A girl came in from the examination rooms and joined the game at once with no invitation or explanation. Howard walked timidly over from the sand table and got upon the chairs. Four children and Stephen were soon lined upon the chairs behind him waiting for Howard to take his turn. Stephen waited a while, then jumped off his chair and going to Howard, said, "Can't you hurry?" Howard did not answer, but moved on slowly since he was really afraid to slide. Stephen pulled him firmly off the chair row. "You're so slow, Howard. You better not play this, you spoil it for us."

Seeking Attention

January 17 (*Group* 1). Sara has spent the first few weeks in persistent attempts to get attention from her companions or from the teacher. She never goes down the slide without calling to some one to look at her, and never makes a cake without insisting on the teacher's "tasting" it. Today some visitors came in. When the children were asked to get their milk Sara refused. She could give no reason, but just said "no." It was evident from the glances she cast at the visitors that this was her way of "showing off." When it became apparent to her that she would have to do as the other children were doing, she took a very long time to drink her milk.

Doing as the Others Do

November 10 (*Group* 1). Wilhelmine went up to Miss S. at once when free play began and said, "Play with me." Miss S. said, "All right. Let's play bear. I am a bear and I'll catch you." Wilhelmine shouted with pleasure and ran. Five other children joined in the game. Miss S. dropped out in a few minutes, but for a long time the children would run up to each other, saying, "I'm a bear." Wilhelmine began to crawl after Philip, to his evident enjoyment. Lawrence dropped on his knees and went growling after the other two. The children would stop and slide or play at the sand and then go back to being "bears" all the morning.

September 25 (*Group* 2). Allen went to the slide and, pushing away a lot of children who were lined up, would have gone down. The children set up a cry and the teacher explained to Allen the necessity of "taking turns." He at once began to watch the others. When any one got out of place he shouted, "Take turns. We must all take turns."

Coöperating with the Group

November 3 (*Group* 2). Two children arranged all the chairs in a row. When asked if they ever arranged the chairs in that fashion elsewhere, they said that they did not, and no further information was gained from them. Several other children came over and sat in the chairs, without disturbing their arrangement. One boy shouted, "All aboard for Chicago." Another child brought over some small blocks and came along the row, saying, "Tickets, tickets" (Fig. 60).

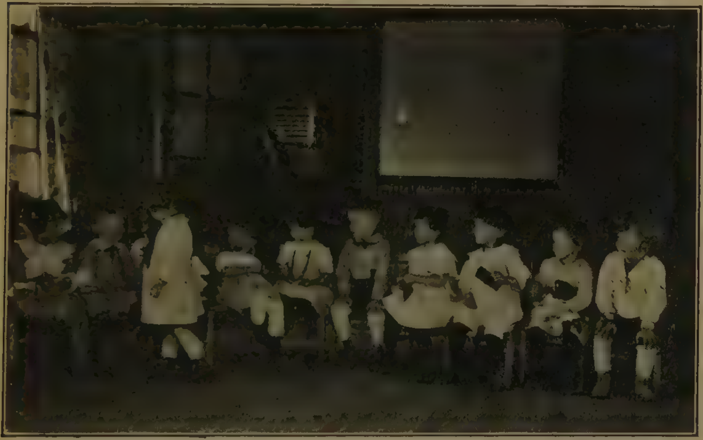

Fig. 60. going to chicago, a game invented by the children.

November 3 (*Group* 1). The half dozen board blocks on the floor were left by chance in a row with the blocks approximating parallels. Sara came over to the pile and straightened the boards into a row of parallel blocks about a foot apart. Then she carefully walked the length of it, stepping over each block. Jamie pushed his block back and carefully added it to this row. He and Sara added several blocks in this way, stopping between times to step along the row. Tommy came up and Sara took control, telling him and Jamie just how to walk, and when to place blocks. Two other girls then came over and began to add blocks carelessly to the row. Sara tried to direct them, but they would not listen. The row soon looked very mussed, and Sara said, "They spoil it," and shook her head seriously. Tommy, wandering among the blocks, kicked one across a pair of the parallels, making a three-sided pen. Another child who had a block in her hand laid it on the other side, making a square. "See the house—we'll all sit in it," Sara said and sat down in it. Jamie sat down with her. Jeanette tried to get in also, but knocked one side out. She then made a square for herself and another little girl. They all did nothing but sit still in these pens for a few minutes.

January 30 (*Group* 1). Robert brought a book to school with him. He and Billy sat down with chairs drawn close together and looked at the book together. Soon two other children had drawn up chairs and were looking at the book while the owner held it in his lap and turned the pages. No child attempted to take the book away from him or to crowd others away in order to get a closer view of the pictures.

January 25 (*Group* 2). Gladys went to the cupboard to get the "corners," the large posts used in building the house with the floor blocks. Four other children immediately joined in building the house (Fig. 61). When it was about half done Stephen crawled into it, saying, "Come into my movie." He had a few colored pictures which he held up against the wall of the house. All the children started to crowd in. Richard stationed himself at the door and said, "I'm taking tickets," and made each child give him an imaginary ticket. This took the rest of the morning. The children would sit on the floor (seven was the capacity of the house), look at the pictures, crowd out, take a few slides or fill a bottle with sand, and then crowd back in, giving tickets to the faithful Richard.

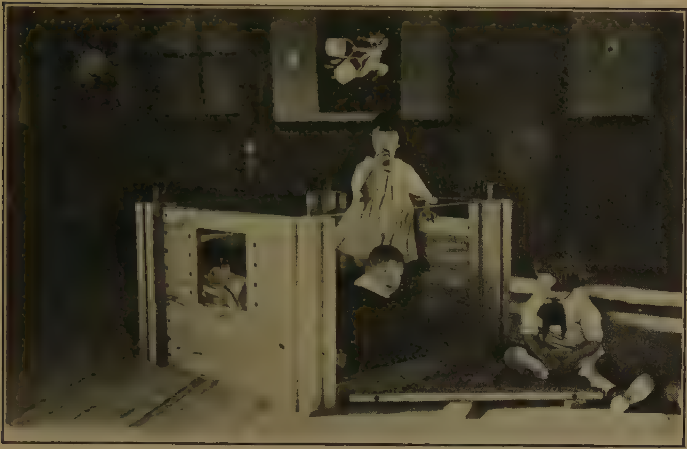

FIG. 61. BUILDING THE HOUSE IS A COÖPERATIVE ENTERPRISE.

Adjustment to Life in Play

The fact that the children adjust themselves so quickly to the requirements of group life disproves the common belief that the child is an individualist up to perhaps six years of age and that it is useless to expect much else before that time.

Mary Elizabeth at the age of two has learned some of life's hardest lessons through the give-and-take of group play. Far from being overstimulated by the laboratory surroundings, she feels a sense of ease and quiet in this environment especially adapted to her needs. All the conversation is on her level, and her vocabulary and control of language have grown enormously because she feels at home and free to express herself. The grown-ups with whom she comes in contact in the laboratory have plenty of time to play with her, to answer questions, and to wait while she slowly learns to perform the little duties of the daily routine. It does not matter if it takes her a long time to put on her coat, and besides the other children are learning too. The milk spilled while she sets the table for lunch does not spoil the party for her as she cheerfully helps wipe it up. A scratch on the phonograph record as she adjusts the needle is merely incidental to the business of learning motor control, whereas in the average home it would result in considerable nervous tension for all concerned. Best of all, she has tasted the joys of companionship with children of her own age and ability, which is a satisfaction that no home nursery, however well stocked with playthings, can give. In other words, she has found her place in the world and is enjoying it several years before she would ordinarily be allowed this privilege.

CHAPTER XII

CONCLUSION

Four centuries of interest in the preschool child on the part of educational philosophers and casual observers of the activities of young children have resulted in so little scientific information in regard to the development of children, that parents do not usually know until a child meets the tests of school life, whether it is accelerated or average in development. Parents and other observers are liable to think that most of the "tricks" of babyhood are manifestations of very unusual ability, merely because it is not commonly known at what age the average child can do these things. On the other hand, those associated with really gifted children are frequently unaware of the fact because they have no standards by which to judge mental ability in the very young child. It is relatively easy even for a person without psychological training to detect differences in mentality in older children, but only a person with rare psychological insight can distinguish the latent differences in intellectual capacity among preschool children. Many well-meaning persons have adopted babies and spent years of anxious care hoping for some improvement in the mentality of what has proved to be a feebleminded child. A clinical psychologist, requested to give advice in regard to the desirability of adopting even a two-year-old child, has few criteria beyond common sense, and can give little help to insure the prospective parents' obtaining a child of good physical and mental development. If a little child is clean, nicely dressed, and reasonably active it usually passes as "healthy" and "bright."

It was to begin the psychological analysis of child development and to furnish at least tentatively some standards of development along physical, mental, educational, and social lines that this study of the preschool child was undertaken at the Iowa Child Welfare Research Station. The results of three years' work with 105 children two to six years of age have not only furnished the data presented in previous chapters and permitted the drawing up of certain principles in regard to child development, but have also shown the need of further experimental work and indicated the future lines of advancement in the educational and social treatment of the young child. It is to help meet the urgent needs of the widespread interest in the study of the care and training of preschool children that this book has been published.

Physical Growth

Little has been done in the way of collecting physical measurements to furnish growth norms for young children. A few parents have measured an individual child from time to time and reported the measurements in a diary or "baby book" with their psychological observations. Physicians have made measurements, especially at birth and during the first year, although mostly on children who are in need of medical care rather than on healthy children. Some babies are being measured from time to time at clinics for babies who are well but require special feeding. These measurements are not usually collected, however, in such a way as to furnish data for growth norms except in a few instances for the first year. Consequently, the well-intentioned parent who keeps a careful record of a child's growth can find nothing but a few tables for height and weight by which to determine whether the child is growing normally. As the preschool age is the time when developmental defects should be detected and corrective measures instituted, the lack of proper standards of growth is a very serious handicap in all child health work. A comparison of the heights and weights of our preschool children in Table II with those given in Table I for children from wider social, national, and geographical samplings shows that the laboratory children are slightly superior in development. Table II, which gives the growth of our preschool children in sixteen physical traits, furnishes a preliminary summary of the growth process in the young child.

A study of Table II shows that these young children grow fairly uniformly in the majority of the physical traits studied. The greatest increases in development for the years from two to six are found in stature, span of arms, and weight, and the least growth is in the size of the head and chest. In anatomical growth the girls are further developed than the boys, and have attained a higher percentage of their six-year stature and weight. The larger children in each of the age groups are apparently accelerated physiologically. Norms such as have been tentatively presented in this book must be extended and supplemented by work on larger numbers of children from other parts of the country and from other classes and races. There is need for consecutive individual growth curves for the most significant physical traits, accurately and frequently taken and supplemented by detailed physical examinations, consecutive records of health habits, and frequent reports on the child's diet. Records of individual growth now being made on babies in welfare stations and clinics should be continued throughout the preschool ages and the results of continuous study of the child's growth made available. Every kindergarten, day nursery, nursery school, or play group for young children should institute the practice of making at least a measurement every three months of height and once a month of weight, supplemented by graphic records to be interpreted to the parents and even to the child.

An outstanding problem of great importance is the question of the significance of physical and mental growth during early childhood. It is not yet known how these two aspects of development correspond or how far and under what conditions they may differ widely. The data and methods of study presented in this book should go far toward helping in the solution of this problem.

Mental Development

The results of the studies so far carried on with the preschool child show that examinations can be devised to give reliable measures of the mental ability of very young children who have heretofore been considered entirely beyond the province of psychological experimentation. The common nursery occupations, packing blocks into their box, building towers, stringing beads, and fitting together puzzle pictures are mental tests in themselves and will be seized upon by the psychologist for the study of mental development. Many of the psychological tests already in clinical use can be employed with children much younger than those on whom the tests were standardized.

The repeated application of the Stanford-Binet test shows that a general intelligence examination of a young child must be very carefully interpreted. The young child seldom reacts well with a stranger and the first mental rating is likely to be lower than the child's true mental status. The child is, moreover, so greatly handicapped in language that it does not always show the ability that a later test demonstrates must have existed, potentially at least. The astonishing increase in mental rating shown by children, who, without unwholesome stimulation, have had the benefit of the educational and social influences of the preschool laboratory should prove of interest to all who are concerned to see that a little child has such an opportunity for development.

What is probably the first learning experiment for a considerable number of preschool children is reported in Chapter III under the head of card sorting. The learning process of little children is characterized by an enormous amount of trial and error with frequent appeals to adults for some guide in the solution of the problem. Often a long period of adjustment is necessary before the child appreciates what it is supposed to do, and even then it often forgets what it was about and begins playing some game of its own invention. Some children spend many practice periods without making any apparent progress and then suddenly seem to gain insight into the problem and make a relatively good score at the end. The card sorting experiment has demonstrated that, without specially elaborate devices for motivation, little children continue at an occupation for a relatively long series of practice trials, contradicting the popular belief that young children are not persistent. Many of the routine duties and accomplishments the child has to learn in life could feasibly be taught by games modeled on this practice experiment.

The experiments on motor control reveal the great lack of aptitude of young children at the simplest acts of skill and show the need for training along manual lines. It is illuminating for a parent, as well as for a psychologist, to witness the young child's difficulty in picking up a block, or in keeping a square box turned in such a way that it will fit into a larger box instead of being set across corners; in holding on to the needle and thread so as not to drop them when stringing beads, or in painfully preventing the occurrence of those inaccuracies of movement that are liable to be called "clumsiness" by the unsympathetic observer.

The person who has watched a little child try to solve a puzzle, such as fitting forms into their holes, realizes how narrow is the boundary between success and failure, and how often mere persistence under judicious encouragement is responsible for final ability to reach the goal. Thus even apparently intellectual traits, such as the ability to reason out a problem, seem to be based to a large extent on character and personality trends. Shyness, for example, or a tendency toward being easily discouraged, often prevents a child's doing as much as its real mental ability warrants. The experiments with tests of the ability to assemble a number of scattered parts of a whole or to fill in the omitted portions of a picture show that young children do not have much constructive imagination. Such concepts as those of number, weight, and time are also revealed in the experimental situation to be rudimentary.

Practically all of the tests employed to determine the development of the children could be used to train the abilities tested. Practice has an enormous effect on these abilities in young children, and the differences between some children may have been due in large measure to home training. The belief of some parents that it is a mistake to teach a little child anything, that it should just grow naturally, is unfounded. The mind, like the body, grows by what it feeds on. Great care should of course be exercised to prevent overstimulation, but other things being equal, to deprive a little child of instruction it craves, is to withhold the conditions for normal mental development. So rapidly do the children grow under the beneficial influence of the preschool laboratory activities that it is sometimes difficult to test an ability soon enough to get it at the earliest stages before unconscious learning in the group room has affected it. For example, the sense of rhythm improves so rapidly as the result of simple musical exercises that it is difficult to decide how early it appears. The color and number words known and the size of the vocabulary in general also show the influence of the laboratory activities on mental development. The path for experimental psychology in the future lies in the direction of a thorough standardization and extension of such norms for mental growth as are tentatively presented in Tables IV and VI. In the formulation of norms, account should be taken of physiological differences in the development of children. Sex differences should be further investigated. The intercorrelations of traits need analysis with a view to showing the interdependence of mental traits. Psychological experiments on æsthetic development should be continued.

Especially fruitful will be the study of still younger groups of children. The Iowa Child Welfare Research Station has already initiated a program of research into the physical and mental development of babies from birth to two years.

Developmental Activities

Increase in knowledge of the psychology of the preschool child is bound to have a profound influence on modern educational practice. It was not realized until a few years ago that it would be possible to bring children two years old together in play groups, and the feasibility of carrying on an educational program was doubted by many. Our experience with the preschool laboratories has shown that the children enjoy for short periods daily a simple educational program and seem to gain in self-control and emotional stability because they feel they are doing some real work instead of passing constantly from one occupation to another. Appreciation of the appeal that really good music makes to little children will result in increased emphasis on this part of the program.

The apparatus, furniture, and equipment listed in Chapter VI have been planned for the special needs of young children and have been studied with a view to their usefulness for this purpose. The discussions of the reaction of the children to these educational materials should prove useful to those who are responsible for similar groups of children.

As a rule parents are inclined to provide young children with toys that are too complicated and are suited to a much higher mental age. A few long blocks give more pleasure to a little boy who wants to play train than an elaborate electrical engine. A further study of the types of toys suitable for various stages of mental development would have great practical value.

The occupational activities outlined for children from two to six years are suggestive of many other types of projects that are educational and yet make a real appeal to the legitimate instinctive desires of these children.

As a result of various educational movements the kindergarten is already undergoing a tremendous change which will be hastened by the admission of younger groups of children. The writers are confident that within a few years the kindergarten will have been divided into several sections. One will be composed of older children who are engaged on projects that are directly preparatory for primary work. Much time will be given to excursions and discussions leading to a better understanding of the physical environment and of the processes by which food, clothing and shelter are provided. Such children can begin the use of numbers in their occupational activities and can have some of the pleasure of reading for themselves in connection with their constructive work. For the younger groups of children the best in the present kindergarten will be supplemented by more provision for forming the simpler habits of daily life and more play activities resembling those of the nursery.

It is perhaps not too visionary to prophesy that ultimately every school that now has a kindergarten will also have at least an hour's work for very young children. Playgrounds in large cities have already become adjusted to this need of the preschool child and are providing for "toddlers" well-equipped play corners with a special teacher in charge. Private schools and nursery schools are accepting children as young as eighteen months. It will not be long before the public school will recognize its duty toward the younger children, not to relieve the mothers of the care of this important period in education, but to help direct this care in the light of scientific analysis of the child and the methods of training.

Social Development

The growing number of organized groups of young children is testimony to the change of attitude of parents in regard to the social needs of the preschool child. It was formerly thought that bringing together a group of young children should be avoided because of the danger from contagious disease. With rigid medical inspection every day and other preventive measures, this danger has been greatly diminished. The older notion that a child might just as well play by itself during the early years has given way to a new appreciation of social values and a realization that the little child requires social contacts with other children. The school child no longer recites to its teacher but shares with its classmates information discovered from study. The child in the preschool laboratories tells a story or sings a song for the entertainment of its playmates unconscious of the fact that this is anything unusual in a child of its age.

The discussions in Chapter XI have brought out the fact that preschool children are not essentially individualistic, but enjoy and spontaneously develop group activities and show many social virtues, such as fair play, responsibility, and consideration for younger children. So keen is the children's interest in these coöperative activities and so great is the power of social control even at an early age that deprivation of the pleasure of being with the group is the only form of discipline needed.

Even at the age of two, children have acquired distinct personalities with certain basic social attitudes to some extent already formed and consistent. These attitudes of young children toward their play groups can be explained largely in terms of common experiences, particularly those of the relationships within the family group. The wide variety in parental attitudes toward children and the influence of earlier experience show that "a good home" must be defined in psycho-sociological terms rather than by standards of material care and comfort alone.

The individual differences among children in general sociability are large and persistent. Children who have had practically the same opportunities for social experience vary widely in the ease with which they approach other children and in the gross number of social contacts that they make in a play group.

Sex differences in the interests and attitudes of children at these early ages should be more thoroughly studied, since this is the period at which social control has not yet had such a profound effect and innate characteristics are more apparent.

Psychological study of character traits will richly repay the experimenter who is able to devise technic for such studies where the usual methods of experimentation are not applicable. In addition to continued work on the social attitudes, there is the possibility of investigating such permanent characteristics of the individual as the tendency of the "shut-in" personality toward too great occupation with personal thoughts and problems, which is known as introversion.

Early participation in group play can do much to correct unfortunate temperamental traits and to develop desirable social qualities. There are handicaps to normal development even when a child is one of a group of children in the home. Certain disabilities result from being the youngest or the oldest child just as much as from being the only child, since a child early tends to take a definite attitude and position in the home group that may carry over when it meets children of its own age. One little boy in the pre-school laboratory had already taken on an air of detachment and much preferred not to play with the other children, but just to sit in his little chair and watch the world go by. The two years of patient and tactful work that it has taken to interest this child in his "fellowmen" will bear fruit in later years when he will be spared the sufferings from maladjustment of the man who can not make the interests of his social group his own. The study of normal as well as of abnormal psychology shows that the earlier a child makes its social contacts and feels itself an integral part of a community the easier does its adjustment come to the requirements of adult life.

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APPENDIX I

CHILDREN'S STORIES AND BOOKS

List A contains stories to tell children and List B, books the children enjoy looking at while the story is being told or read.

LIST A

ANONYMOUS, *National Rhymes of the Nursery* (New York, Stokes).

———, *All About the Three Little Pigs* (New York, Cupples and Leon), nine other stories in series.

———, *Folk Lore, Fables and Fairy Tales,* Boys' and Girls' Bookshelf, Vol. II (New York, The University Society).

BISHOP, R. M., *The Mermaid's Message* (Springfield, Mass., Milton Bradley).

DE LA RAMÉE, L., *Bimbi* (Boston, Ginn and Co.).

GASKOIN, H., *Children's Treasury of Bible Stories* (New York, Macmillan).

HOFER-PROUDFOOT, A., *Child's Christ Tales* (Chicago, Flanagan).

KIPLING, R., *Just So Stories* (New York, Doubleday, Page).

MABIE, H. W., *Norse Stories* (New York, Dodd, Mead).

MITCHELL, L. S., *Here and Now Story Book* (New York, Dutton).

POULSSON, E., *In the Child's World* (Springfield, Mass., Milton Bradley).

RICHARDS, L. E., *The Silver Crown* (Boston, Little, Brown).

———, *The Golden Windows* (Boston, Little, Brown).

SLOSSON, A. T., *Story-Tellers' Library* (New York, Scribner).

UNDERHILL, Z. D., *The Dwarf's Tailor* (New York, Harper).

LIST B

ADELBORG, O., *Clean Peter* (New York, Longmans, Green).

ANONYMOUS, *Mother Goose; or The Old Nursery Rhymes* (New York, Warne).

Anonymous, *Mother Goose* (New York, P. F. Volland, who also publishes a large number of other books suitable for young children).

———, *The Real Mother Goose* (New York, Rand McNally).

Bailey, A. S., *Sleepy Time Tales,* a large series (New York, Grosset and Dunlap).

Bannerman, H., *Little Black Sambo* (New York, Stokes).

Brooke, L., *Johnny Crow's Garden* (New York, Warne).

———, *A Nursery Rhyme Picture Book* (New York, Warne).

Browning, R., *The Pied Piper of Hamelin* (New York, Warne).

Caldecott, R., *R. Caldecott's Picture Book No. 1* (New York, Warne).

———, *R. Caldecott's Picture Book No. 2* (New York, Warne).

Crane, W., *The Buckle My Shoe Picture Book* (New York, Lane).

———, *Mother Hubbard Picture Book* (New York, Lane).

———, *Song of Sixpence Picture Book* (New York, Lane).

Field, E., *Poems of Childhood,* illustrated by M. Parrish (New York, Scribner).

———, *Lullaby Land,* illustrated by Robinson (New York, Scribner).

Francis, J. G., *Book of Cheerful Cats* (New York, Century).

———, *The Golden Goose Book* (New York, Warne).

Goodwin, E. S., *Rhymes of Real Children* (New York, Fox, Duffield).

Greenaway, K., *Marigold Garden* (New York, Warne).

———, *Under the Windows* (New York, Warne).

Le Mair, H. W., *Auntie's Little Rhyme Book* (Philadelphia, David McKay).

———, *The Children's Corner* (Philadelphia, David McKay).

———, *Grannie's Little Rhyme Book* (Philadelphia, David McKay).

———, *Mother's Little Rhyme Book* (Philadelphia, David McKay).

———, *Nursie's Little Rhyme Book* (Philadelphia, David McKay).

Moore, C. C., *'Twas the Night Before Christmas* (New York, Houghton Mifflin).

Potter, B., *The Tale of Peter Rabbit* (New York, Warne).

Riley, J. W., *Child Rhymes* (Indianapolis, Bobbs-Merrill).

———, *The Book of Joyous Children* (Indianapolis, Bobbs-Merrill).

Smith, E. B., *The Farm Book* (New York, Houghton Mifflin).
———, *The Railroad Book* (New York, Houghton Mifflin).
Stevenson, R. L., *Child's Garden of Verses*, illustrated by F. Storer (New York, Scribner, 1923), 115 p.
Whitney, H. H., *Bed-time Book* (New York, Duffield).
Whittier, J. G., *Child Life: Poems* (New York, Houghton Mifflin).

APPENDIX II

CHILDREN'S SONGS

ANONYMOUS, *Mother Goose Songs My Children Love* (New York, Noble).

———, *Songs of City Life* (New York, A. S. Barnes).

———, *Folk Songs and Other Songs for Children* (New York, Ditson).

———, *Musical Nursery Rhymes,* Diploma Series (New York, Small).

———, *Silver Song Series* (New York, Silver).

AYRES, F., *Mother Goose Melodies* (New York, Schirmer).

BAKER, C. B., *Songs for the Little Child,* folk melodies (New York, The Arlington Press).

BENTLEY, A. E., *Play Songs* (New York, Barnes).

CARPENTER, J. A., *Improving Songs for Anxious Children* (New York, Schirmer).

CHEATHAM, K., *A Nursery Garland* (New York, Schirmer).

———, *Her Book* (New York, Schirmer).

COONLEY, L. A., and SMITH, E., *Singing Verses for Children* (New York, Macmillan).

CRAMM, H. L., *Mother Goose* (New York, Ditson).

CRANE, W., *The Baby's Opera, A Book of Old Rhymes with New Dresses, the Music by the Earliest Masters* (London, Warne).

———, *The Baby's Bouquet, a Fresh Bunch of Old Rhymes and Tunes* (London, Warne).

CROWNINSHIELD, E., *Mother Goose Songs for Little Ones* (Springfield, Mass., Milton Bradley).

———, *R. L. Stevenson Songs* (Springfield, Mass., Milton Bradley).

DAMROSCH, F., *A Birthday Greeting and Other Songs* (New York, Schirmer).

DEKOVEN, R., and OTHERS, *Songs of Childhood,* verses by Eugene Field (New York, Scribner).

EDDY, H. P., *Tree Top Times for Tiny Tots* (New York, Ditson).

ELLIOTT, J. W., *Mother Goose's Nursery Rhymes and Nursery Songs* (New York, McLaughlin).
EVERSON, G. R., *Come Sing With Me* (New York, Ditson).
FISHER, W. A., *Posies from A Child's Garden of Verse by R. L. Stevenson* (New York, Ditson).
FOSTER, M. K., *A Day in a Child's Life* (London, Routledge).
FRUEAUFF, A., *Tunes for Tiny Tots* (New York, Schirmer).
GAYNOR, J. L., *Songs of the Child World,* Nos. 1 and 2 (New York, Church).
———, *Playtime Songs* (Chicago, Summy).
———, *Lilts and Lyrics* (Chicago, Summy).
———, *Songs for Little Children* (Springfield, Mass., Milton Bradley).
GERMAN, E., and KIPLING, R., *Just So Song Book* (New York, Doubleday, Page).
GOEDHART, A., *Children's Songs* (Chicago, Summy).
GOTTSCHALK, L. F., *Historical Mother Goose* (New York, Schirmer).
HANK, A., *Teeny Tiny Sheet Music to Cut, Color and Sing* (New York, Noble).
HILL, M., and P., *Song Stories for the Kindergarten* (Chicago, Summy).
HOTCHKISS, E. D., *Children's Songs* (Chicago, Summy).
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MORRATT, J., *Nursery Songs* (New York, Nelson).
NIGHTINGALE, A., *Nursery Rhymes* (New York, Macmillan).
NEEDHAM, *A Child's Life in Song* (Chicago, Summy).
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OLDS, W. B., *Twenty-five Bird-songs* (New York, Schirmer).
———, *Second Book of Bird Songs* (New York, Schirmer).
PALMER, S. E., *Everyday Songs and Rhythms* (Chicago, Summy).
PLUMMER, R. H., *Little Homespun Songs and Verses* (New York, Stokes).

Poulsson, E., *Holiday Songs and Every Day Songs and Games* (Springfield, Mass., Milton Bradley).

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Smith, D. S., *Four-and-twenty Little Songs* (New York, Schirmer).

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———, *Song Devices and Jingles* (New York, Lothrop).

Stein, E., *Child Songs of Cheer* (New York, Lothrop).

Terhune, A., *Our Very Own Song Book* (Chicago, Summy).

———, *Barnyard Ballads* (New York, Schirmer).

———, *A Chinese Child's Day,* illustrated (New York, Schirmer).

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———, *Songs of our Street* (New York, Schirmer).

Whelpley, B., *Songs for Tom, Dick, Bob and Peggy* (Boston, Boston Music Co.).

Zucca, M., *A Child's Day in Song,* illustrated (New York, Schirmer).

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APPENDIX III

PHONOGRAPH RECORDS

For Appreciation

18094–V*—"Minuet" (Boccherini); "Traumerei" (Schumann).

18655–V —"How Lovely are the Messengers" (Mendelssohn); "See, the Conquering Hero Comes" (Handel); "If With All Your Hearts" (Mendelssohn); "Pastoral Symphony" (Handel).

17600–V —"A Serenade" (Drigo); "At the Brook" (René de Boisdeffre).

64576–V —"Serenade" (Moszkowski).

18648–V —"To a Water-Lily" (MacDowell); "Spring Song" (Mendelssohn).

18759–V —"Heavenly Aïda" (Verdi); "Heaven May Forgive You" (Flotow); "Habanera" (Bizet); "Miserere" (Verdi); "Song to the Evening Star" (Wagner); "Toreador Song" (Bizet); "Soldier's Chorus" (Gounod); "Woman is Fickle" (Verdi).

18800–V —"Badinage" (Herbert); "Legend of the Bells" (Planquette); "Humoresque" (Dvorak); "Scherzo from Third Symphony" (Beethoven); "Menuet" (Paderewski); "Gavotte" (Popper); "Menuet" (Beethoven).

17454–V —"Humoresque" (Dvorak); "Berceuse" (Godard).

18622–V —"Hush, My Babe" (Rousseau); "Happy Land" (Hindoostan Air); "Come, Thou Fount of Every Blessing" (Wyeth); "Lullaby" (Jakobowski); "Birds in the Night" (Sullivan).

18754–V —"Marche Romaine" (Gounod); "Gavotte in B Flat" (Handel); "Giga" (Corelli); "Second Gavotte" (Sapelinikiff).

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* Victor records are indicated by V, Columbia records by C.

18216–V —"Old English Dance" (Smith); "Gavotte" (Thomas); "Moment Musical" (Schubert); "Mazurka" (Chopin).

3100–C —"March" (Schubert); "March" (Gade); "March" (Schubert); "Soldier's March" (Schumann).

3096–C —"Soldier's March" (Gounod); "March" (Tschaikowsky); "March" (Raff); "March" (Bach-MacDowell).

3098–C —"Minuet" (Mozart); "Swiss Maid"; "Scherzo, Allegretto, and Trio" (Schubert); "Waltz" (Koschat).

3125–C —"Huntsman's Song" (Meyerbeer); "Gypsy Rondo" (Haydn); "Bonnie Dundee" (Traditional); "Within a Mile o' Edinborough Town" (Traditional).

3126–C —"Gallop" (Suppe); "Theme from Sonata No. 1" (Haydn); "Marche Militaire, Allegro" (Schubert); "Marche Militaire, Trio" (Schubert).

3127–C —"Theme and Variation II" (Chopin); "Gavotte" (Leoncavallo); "Amaryllis" (Ghys); "Gavotte" (Gossec).

3095–C —"Sleep, Baby, Sleep" (Mozart); "Rock-a-Bye, Baby" (Mozart); "Lullaby" (Schubert); "Cradle Song" (Schubert).

3119–C —"All Through the Night" (Traditional); "Sweet and Low" (Barnby); "Lullaby" (Taubert); "Cradle Song" (Taubert).

3120–C —"Little Sandman" (Brahms); "Lullaby" (Brahms); "The Mother's Song" (Kucken); "Golden Slumbers" (Traditional).

3121–C —"Silent Night" (Old Melody); "Away in a Manger" (Luther's Hymn); "O'er the Cradle of a King" (Old Breton Melody); "Cradle Hymn of the Blessed Virgin" (Barnby).

3094–C —"Prelude in A Major" (Chopin); "Morning Mood" (Grieg); "Minuet" (Boccherini); "Andantino" (Thomas).

3093–C —"Berceuse" (Delbruck); "Berceuse" (Karganoff); "Minuet in G" (Beethoven); "Andante Célèbre" (Beethoven).

3122–C —"Theme from Ninth Symphony" (Beethoven); "Allegretto, Seventh Symphony" (Beethoven); "Theme from Andante, Fifth Symphony" (Beethoven);

"Allegro" (Beethoven); "Tempo di Minuetto" (Beethoven).

3123–C —"March of the Men of Harlech" (Traditional); "March" (Handel); "Andante Theme" (Mozart); "Berceuse" (Iljuisky).

DESCRIPTIVE

35324–V —"In a Clock Store" (Orth); "A Hunt in the Black Forest" (Voekler).

35679–V —"Santa Claus Tells about his Toy Shop and Gives Away his Toys" (Girard).

55054–V —"Naughty Marietta" (Herbert); "March of the Toys" (Herbert).

18598–V —"Of a Tailor and a Bear" (MacDowell); "The Wild Horseman" (Schumann); "Spinning Song"; "The Little Hunters."

18753–V —"Canzonetta" (Hollaender); "In the Forest" (Staub).

17735–V —"Songs and Calls of our Native Birds" (Gorst).

18853–V —"To a Humming Bird" (MacDowell); "Elfenspiel" (Klerulf); "The Witch" (Tschaikowsky); "March of the Tin Soldiers" (Tschaikowsky); "Knight of the Hobbyhorse" (Schumann); "The Clock" (Kullak); "Postillion" (Godard); "Peasant's Dance" (Scytte).

3128–C —"Wild Rider" (Schumann); "March" (Hollaender); "Knight of the Hobbyhorse" (Schumann); "The Huntsmen" (Gurlitt).

3124–C —"Rider's Story" (Schumann); "Children's Dance" (German); "Hallowe'en," "Rhythm" (Heller); "The Train," "Rhythm" (Mendelssohn).

FOR SINGING

17776–V —"Blue Bird;" "Mr. Duck and Mr. Turkey;" "Six Little Puppies;" "Little Birdie;" "Tiddley-Winks and Tiddley-Wee;" "The Chicken;" "The Bunny;" "Mr. Squirrel."

18015–V —"Household Hints;" "Cat-tails;" "Daffodils;" "Gingerbread Man;" "Jap Doll" (Riley-Gaynor).

18448–V —"The Slumber Boat" (Riley-Gaynor); "Hey Baloo."

18330–V —"Pull a Cherry;" "The Nightingale;" "The Fire;" "See-Saw, Margery Daw" (Fullerton-Gray); "The Postillion" (Taubert); "Lullaby" (Lithuanian Folk-Song); "The Spanish Gypsy" (Spanish Folk-Song); "The Linden Tree" (Schubert).

18076–V —"Humpty-Dumpty;" "To Market;" "Crooked Man;" "Tommy Tucker;" "Mother Hubbard;" "Sing a Song of Sixpence;" "I Love Little Pussy;" "Georgie Porgie;" "Pussy-Cat;" "Feast of Lanterns."

17004–V —"A Dew Drop" (Sherman-Gilchrist); "Rain Song" (Smith); "Hey Diddle, Diddle;" "Little Bo-Peep;" "Twinkle, Twinkle;" "Little Jack Horner;" "Ride a Cock Horse" (Elliott).

17719–V —"Jack in the Pulpit;" "In the Belfry;" "Corn Soldiers;" "Naming the Trees;" "The Squirrel;" "The Windmill;" "Riggety Jig;" "The Singing School;" "Dancing Song;" "Dancing in May;" "Mother Goose Lullaby."

17513–V —"The Cuck-coo Clock" (Terhune); "Slumber Song" (Pfirshing-Schaefer); "The Secret;" "The Old Chanticleer;" "The Hungry Windmill."

17937–V —"Baa, Baa, Black Sheep;" "How Many Miles to Babylon;" "Bobbie Shafto;" "Baby Dear;" "Little Shoemaker;" "Songs of Iron;" "The Blacksmith."

17332–V —"Mother Goose Jingles;" "The Little Red Hen."

3143–C —"Indian Lullaby;" "Waiting to Grow;" "The Wind;" "Shoemaker John" (Aiken).

3144–C —"Salute To The Flag" (Riley-Gaynor); "The Owl" (Riley-Gaynor); "The Slumber Boat" (Gaynor).

3145–C —"The Little Shoemaker;" "Evening;" "Sweet-Pea Ladies;" "Water-Lilies" (Riley-Gaynor).

3146–C —"Apple Blossoms;" "April Showers;" "Pussy Willow;" "My Little Yellow Duck" (Churchill-Grindell).

3147–C —"The Daisy;" "Dandelion" (Churchill-Grindell); "Silver Moon;" "My Fiddle"; "Mother Hen" (Hartley).

MARCHES AND RHYTHMS

35208–V —"High School Cadets March;" "Semper Fidelis."

16001–V —"The Teddy Bear's Picnic;" "Happy Days March."

35657–V —"Patriotic Medley March;" "The Standard Bearers' March."
18852–V —"Boating on the Lake" (Kullak); "Skating" (Kullak); "Walzer" (Gurlitt); "March" (Gurlitt); "La Bergeronette" (Burgmuller); "Waltz" (Schubert); "Scherzo" (Gurlitt); "L'Arabesque" (Burgmuller); "Le Secret-Intermezzo" (Gauthier).
18840–V —"Run, Run, Run" (Concone); "Jumping" (Gurlitt); "Running Game" (Gurlitt); "Air De Ballet" (Jadassohn); "Waltzer" (Brahms).
18253–V —"Motive for Skipping;" "Theme for High Stepping Horses;" "Horses or Reindeer Running;" "Theme for Skipping."
17087–V —"Minuet Don Juan" (Mozart); "May Pole Dance" (Burchenal).
18548–V —"Rhythm Medleys" (Anderson).
3097–C —"Fantasy Piece" (Schumann); "With Castanets" (Reinecke); "Gavotte" (Fliege); "Gavotte" (De Koven).
3129–C —"Entr'acte and Valse" (Adam); "Air No. 10" (Adam); "Air No. 7" (Adam); "Trio No. 2" (Adam).
3130–C —"Rataplan" (Donizetti); "Serenata" (Moskowski); "Waltz" (Koschat); "Gypsy Rondo" (Haydn); "Shadows" (Schytte).
3099–C —"Idyll" (Koschat); "Allegretto" (Schubert); "Trio" (Schubert); "Étude" (Schytte).

GAMES

17084–V —"Klappdans;" "Shoemaker's Dance."
17567–V —"The Needle's Eye;" "Jolly is the Miller;" "Looby Loo;" "Oats, Peas, Beans, and Barley."
17568–V —"Let Us Chase the Squirrel;" "How-do-you-do, My Partner;" "The Muffin Man;" "Soldier Boy;" "Did You Ever See a Lassie."
17104–V —"London Bridge;" "Here We Go Round the Mulberry Bush;" "Round and Round the Village."

APPENDIX IV

REFERENCES ON PHYSICAL EDUCATION

Bancroft, J. H., *Games for the Playground, Home, School, and Gymnasium* (New York, Macmillan, 1910), 456 p.

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Bentley, A. E., *Play Songs* (New York, Barnes), 66 p.

Brown, F. W., and Boyd, N. L., *Old English and American Games* (Chicago, Saul Brothers, 1915), 55 p.

Curtis, H. S., *The Practical Conduct of Play* (New York, Macmillan, 1915), 330 p.

Hofer, M., *Children's Old and New Singing Games* (Chicago, A. Flanagan, 1914), 42 p.

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Lee, J., *Play in Education* (New York, Macmillan, 1918), 494 p.

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Stecher, W. A., *Games and Dances* (Third revised edition, Philadelphia, McVey, 1920), 357 p.

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REFERENCES ON OCCUPATIONAL ACTIVITIES

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GARRETT, L. B., *Study of Animal Families in Schools* (New York, Bureau of Educational Experiments, 1917), 19 p.

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REYNOLDS, H. M., *Course of Study in Terms of Children's Activities for Kindergarten and Primary Grades* (Seattle, Wash., Helen Reynolds, 846 Central Bldg., 1922), 80 p.

ROBINSON, J., "Project in Community Life in the Kindergarten," *Elementary School Journal,* Vol. 22, November, 1921, pp. 194-203.

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APPENDIX VI

SUPPLY HOUSES FOR MATERIALS AND APPARATUS

Stanford-Binet Blanks and Materials (Houghton Mifflin Co., Boston).

Directions for Administering Stanford-Binet Test in *The Measurement of Intelligence,* by Terman (Houghton Mifflin Co., Boston).

Detroit Kindergarten Mental Test Blanks (World Book Co., Yonkers-on-Hudson, New York).

TEST MATERIALS

Stanford-Binet Materials (Houghton Mifflin Co., Boston).

Wallin Peg Board (C. H. Stoelting, 3037-3047 Carroll Ave., Chicago, Ill.).

Goddard Form Board (C. H. Stoelting, 3037-3047 Carroll Ave., Chicago, Ill.).

Mare and Foal Picture Board (C. H. Stoelting, 3037-3047 Carroll Ave., Chicago, Ill.).

Form Cancellation Blanks (C. H. Stoelting, 3037-3047 Carroll Ave., Chicago, Ill.).

Porteus Maze Blanks (C. H. Stoelting, 3037-3047 Carroll Ave., Chicago, Ill.).

Three-Hole Apparatus (C. H. Stoelting, 3037-3047 Carroll Ave., Chicago, Ill.).

Adaptation Board (C. H. Stoelting, 3037-3047 Carroll Ave., Chicago, Ill.).

Manikin Test (C. H. Stoelting, 3037-3047 Carroll Ave., Chicago, Ill.).

Ship Test (C. H. Stoelting, 3037-3047 Carroll Ave., Chicago, Ill.).

APPARATUS

Teeter and slide (Fred Medard Co., DeKalb and Potomac Sts., St. Louis, Mo.).

Swings (Howard George, Frankford, Philadelphia, Pa.).
Duck rocking chair (Reedsborough Chair Co., Reedsborough, Vt.).
Dolls (Schoenhut Co., Sepviva and Adams St., Philadelphia, Pa.).
Blocks (Schoenhut Co., Sepviva and Adams St., Philadelphia, Pa.).
Wooden beads and other kindergarten materials (Milton Bradley Co., Springfield, Mass.).
Moulthrop chair desks (Langslow-Fowler Co., Rochester, N. Y., Thos. Charles Co., agents, 2249-53 Calumet Avenue, Chicago, Ill.).

APPENDIX VII

GUIDE FOR OBTAINING HOME INFORMATION *

Child's Name....................**Date of Birth**.............

I. FAMILY

A. *Father* ....Date of Birth.............
Place of Birth.............

1. Occupation—present, former..................
2. Education—schools, degrees..................
3. Affiliation with Organizations:
   Church, social clubs, civic groups, scientific and literary organizations.......................
4. Special Interests:
   Art, music, literature, science, church work, social work, reform, politics, mechanics, woodcraft, athletics, gardening, hunting, sports.....
5. Health:
   General condition, known defects............

B. *Mother* ....Date of Birth.............
Place of Birth.............

1. Occupation—present, former..................
2. Education—schools, degrees..................
3. Affiliation with Organizations:
   Church, social clubs, civic groups, scientific and literary organizations.......................
4. Special Interests:
   Art, music, literature, science, church work, social work, reform, politics, mechanics, woodcraft, athletics, gardening, hunting, sports....
5. Health:
   General condition, known defects............

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* For actual use this blank was printed with wide spaces between sections to permit of full accounts of information obtained under the various headings.

C. *Children*
  Names (in order of birth)..Dates of Birth.........
  Special Characteristics..
D. *Other Members of Family*........................

II. HOME
  A. *House*
    1. Type ....
    2. Number of Rooms...........................
    3. Children's Play Room.......................
    4. Furniture and Decoration...................
  B. *Household Management*
    1. Maids ....
  C. *Cultural Values*
    1. Books and Magazines........................
    2. Musical Instruments and Talent in Family; Phonograph ....
    3. Pictures ....
  D. *Neighborhood* ....
  E. *Visitors and Friends*............................
  F. *General Impression of Home*....................

III. THE CHILD
  A. *Physical Development*
    1. Birth:
      Type, weight, and height at birth............
    2. Feeding:
      Breast, artificial ....
    3. Early History:
      Walking, talking, teeth......................
    4. Health before Entrance to Preschool:
      General condition, illnesses..................
    5. Health Habits with Especial Reference to Rising, Bedtime, Sleep, and Diet:
  B. *Mental Development*
    1. Early History with Details
      Was baby book kept?......................
    2. Educational Development
      Reading:
        Does child read? Do members of family read to child? Favorite books and magazines? ....

Writing:
Drawing:
Definite program of instruction:
Time for teaching child; subjects taught; special instructors; system...............

C. *Recreational and Developmental Activities and Equipment*

1. Story-telling by Elders........................
2. Activities with Elders........................
3. Entertainment Outside the Home:
Moving pictures; how often?
Concerts
4. Games: favorite, original:
5. Toys:
Dolls
Doll house
Stuffed animals
Barn
Mechanical toys
animals
train
engine
automobile
Kiddie kar
Wagon
Noah's ark
Rocking horse
Beads
Blocks: alphabet
number, puzzle,
building
Pencils
Crayons
Water colors
Pens
Moulding clay
Types
Scissors
Needle
Sewing cards
Scrap books
Ball
Gymnasium apparatus
Swing
Teeter
Slide
Sand table or pile
Tricycle

6. Pets:
Cat
Dog
Rats
Mice
Fish
Birds
Rabbits
Pony
Farm animals

7. Play and Playmates
Daily play time alone........................
Daily play time with playmates in family......

- Daily play time with playmates outside family
- Imaginary playmates ....
- Number of playmates outside family..........

D. *Social Development*

1. Within Family Group
   - Daily time spent with mother...............
   - Daily time spent with father................
   - Daily time spent with family group..........
2. Organized Groups Outside of Family...........
3. Responsibilities for Self and Home............
   - Dressing, bathing, eating, home duties, allowance, care of younger members of family....

E. *Religious Development*

1. Type of Religious Training...................
2. Sunday School ....

F. *Mother's Characterization of Child*

1. Temperament and Habits......................
2. Discipline and Difficulties with Child..........
3. Special Abilities and Tastes...................

IV. RACIAL HISTORY

	Paternal Grandfather	Paternal Grandmother	Maternal Grandfather	Maternal Grandmother
Birthplace				
Education				
Occupation ...				
Health				
Special Characteristics				

INDEX

Adaptation board, use of, in tests, 106, 110-112, 173.
Adults, imitation of, 244, 245, 248-250.
Æsthetic experience, 212, 213, 227-229.
Æsthetics, tests in, 141-151.
Age, mental, 57.
Ages, anatomical and physiological, 42-44.
Ament, W., book by, 8, 11, 267.
Anatomical changes, 42-46.
Apparatus, 186-188.
  supply houses for, 291, 292.
Apperception, tests in, 7, 115-123.
Appreciation, training in, 283-285.
Association, tests in, 106-115, 128-140.
Attention, desire for, 245, 250.

Baker, H. J., and Kaufmann, H. J., book by, 267.
  tests by, 12.
Baldwin, B. T., books by, 27, 267.
  outlines by, 10.
Baldwin, J. M., book by, 267.
  educational theory of, 8.
Baldwin-Wood, standards of, 35, 36.
Ballard, P. B., studies by, 12, 267.
Balls, play with, 195, 196.
Barnes, E., studies by, 8, 11, 267.
Barrows, Sarah T., tests by, 138.
Bartholomai and Schwabe, child studies by, 10, 267.
Basedow, J. B., book by, 267.
  educational theories of, 6.
Bateman, W. G., book by, 267.
  study by, 11.
Beads, use of, in tests, 146-149, 198, 199.
Beckmann, H., studies by, 10, 268.
Behavior, group, 180-184, 201-234, 240-254, 263-265.
Behaviorism, 13.
Berlin (Germany), school at, 7.
Bibliography, 273-276.
Binet, A., book by, 268.
  studies by, 10, 113, 123, 155, 164.
Binet, A., and Simon, T., book by, 268.
  tests by, 12.
Biographical Sketch, 11.
Biographies of babies, 9.
Bird, G. E., book by, 268.
  tests by, 12.
Blackboards, 191.
Blattner, Helene, tests by, 135.
Blocks, use of, 195.

Boys, measurements of, 34-39, 46-49.
  mental development of, 57-73, 171-174, 177-179.
Brown, E. E., studies by, 11, 268.
Bühler, K., book by, 8, 268.

Cancellation tests, 88-91.
Cards, sorting of, 64-73.
Carpal bones, growth of, 40-43, 46-49, 179.
Children, ages of, 42.
  benefits of preschool training of, 24, 25.
  information concerning, 293-296.
  measurements of, 26-39.
  mental development of, 50-73.
  sex differences in, 45-49.
Children's books, lists of, 277-279.
Children's Bureau, Federal, establishment of, 1.
Children's songs, list of books of, 280-282.
Christian education, volume on, 7, 8.
Claparède, E., book by, 8, 268.
College of Education, coöperation with, 17, 21.
Color, tests in, 123-134, 173.
Color blindness, tests for, 124.
Color-card sorting, 126-128, 173.
Comenius, J. A., book by, 268.
  educational theory of, 5, 7.
Compayré, J. G., book by, 268.
  educational theory of, 8.
Concepts, 4, 10, 12, 24, 51, 109, 152-169.
Consonants, pronunciation of, 136, 137.
Constructive activities, 213-217, 230-233.
Coöperation, 33, 246, 251, 252.
Coördination, 89-105.
Correlation between traits, 46-49, 60-62, 67, 70, 174-179.
Court, S. R. A., studies by, 10, 268.
Courtis reading material, 200.
Courtis Standard Practice Tests, 200, 220.
Crayons, 199, 200.

Darwin, C., book by, 11, 268.
Day nurseries, 16.
Dearborn, G. Van N., book by, 268.
  notes by, 10.
Dearborn, W. F., book by, 268.
  tests by, 12.
Decroly, O., and Degand, J., books by, 268, 269.
  studies by, 10, 11, 155, 164.
Decroly, O., and Monchamp, book by, 269.
  plays by, 14.
Defectives, training of, 14, 15.
Department of Kindergarten-First Grade Education, inventory by, 269.
Descoeudres, A., studies by, 12, 130, 133, 155, 164, 269.
Design, tests in, 145-150.
Detroit kindergarten test, 62-64.
Detroit, school at, 16.
  tests in, 53, 62-64, 172, 175, 176.
Developmental activities, 261-263.

Dewey, J., books by, 269.
  philosophy of, 13, 14.
Dix, K. W., books by, 269.
  diary of, 10.
Dolls, use of, 193.
Dramatic play, training in, 202, 203, 219.
Drawing, 11.
Drever, J., study by, 11, 269.
Drummond, M., book by, 8, 269.
Drummond, W. B., book by, 8, 269.

Ebbinghaus, tests by, 115.
Education, Thoughts on, publication of, 5.
Education of Man, publication of, 7.
Educational activities, 201-234.
Emile, doctrines in, 5, 6.
Engel, A. M., book by, 269.
  tests by, 12.
Esper, E. A., study by, 11, 269.
Excursions, 205, 206, 225, 226.
Experimental methods, use of, 2, 8, 10, 17, 18.
Experimental psychology, beginnings of, 2, 3.

Filbig, J., studies by, 10, 269, 270.
First Steps in Mental Growth, 8.
Fisher, D. C., book by, 270.
  methods of, 14, 15.
Form board, Goddard-Seguin, 80, 81.
  mare and foal, 82, 83.
Form cancellation tests, 88, 89, 172.
Form perception, growth of, 74-105.
Freeman, F. N., studies by, 11, 222, 270.
Froebel, F., book by, 270.
  preschool work outlined by, 7, 14.
Furniture, description of, 188-200.

Games, 211, 212.
Gates, G. S., studies by, 12, 270.
Gaupp, R., book by, 8, 270.
Gerlach, F. M., study by, 11, 270.
Gesell, A. L., book by, 270.
  public hygiene discussed by, 1.
Girls, intelligence tests of, 57-73, 171-174, 177-179.
  measurements of, 34-38, 43, 44, 46-49.
Gluck, tests by, 122.
Goddard, H. H., book by, 270.
  tests by, 10, 74, 110-112.
Goddard form board, experiments with, 80, 81, 85, 172.
Gordon, K., studies by, 11, 270.
Groos, K., book by, 8, 12, 270.
Group, attitude toward, 240-242, 246, 251, 252.
Growth norms, discussion of, 33-37.
Growth, physical, measurement of, 27-32.
Gruenberg, B. C., book by, 8, 270.
Guide, for obtaining home information, 293-296.

Hall, G. S., book by, 189, 270.
  questionnaires of, 9, 10.
Hall, W. S., book by, 270.

Hall, Mrs. W. S., records of, 10.
Healy picture completion test, 82, 119-122.
Height, measure of, 177, 178.
  norms for, 34-39.
Herbart, J. F., book by, 270.
  educational theory of, 6, 7.
Herring, J. P., book by, 271.
  tests by, 12.
Heyfelder, book by, 11.
Hogan, L. E., book by, 271.
  records by, 10.
Holden, E. S., book by, 271.
  vocabulary study by, 11.
Holidays, observation of, 217, 218.
Holley, C. E., book by, 271.
  tests by, 12.
Hollingworth, L. S., studies by, 11, 271.
Holmgren, tests by, 124.
Homes, information concerning, 293-296.
Houses, use of, in tests, 150.
Hug-Hellmuth, H. von, book by, 12, 271.
Hunt, J. L., Johnson, B. J., and Lincoln, E. W., book by, 271.
Hunter, W. S., book by, 271.
  experiments by, 13.

Ide, G. M., studies by, 10, 271.
Individual profile, plotting of, 41.
Infant schools, 15, 16.
Intelligence, general, 25, 50, 53-73.
Intelligence quotient, 57-64, 70, 72, 171, 174, 177, 221, 222, 235-239.
Interest, value of, 7.
Iowa Child Welfare Research Station, work of, 3, 17, 18, 23.
Iowa Preschool Psychological Laboratories, work of, 16-24.

Jespersen, O., studies by, 11, 271.
Johnson, B. J., test by, 98, 99.
Johnson, B. G., and Schriefer, L., book by, 271.
  tests by, 10, 11.
Johnson, H. M., and Reuben, C. S., book by, 271.
  report by, 16.
  tests by, 10.
Junior primary children, training of, 21, 22.

Katz, D., book by, 271.
  experiments by, 13.
Katz, D., and Révész, G., book by, 271.
  experiments by, 13.
Keilhau (Germany), school at, 7.
Kind und Welt, 9.
Kindergartens, 7, 15, 16.
King, I., book by, 8, 272.
Kingsbury, F. A., tests by, 12, 272.
Kirkpatrick, E. A., book by, 8, 272.
Knox, tests by, 122, 173.
Knox cube, use of, in tests, 106-109, 173.
Kuhlmann, F. A., tests by, 12, 272.

Laboratory method of study, use of, 2, 3.
Lacing cards, 196.
Lange, K., studies by, 10, 272.
Language, tests in, 11, 106, 128, 134-140.
  training in, 201, 219.
Lattice pens, 191.
Lay, W., book by, 12, 272.
Leadership, 235-265.
Learning, means of, 7.
  tests and discussion of, 64-73.
Literary appreciation, training in, 201, 202, 219.
Löbisch, I. E., book by, 8, 272.
Locke, J., book by, 272.
  educational theory of, 5.
Lucas, A., book by, 272.

McMillan, M., book by, 15, 272.
Magni, J. A., study by, 11, 272.
Major, D. R., book by, 8, 272.
Manikin, tests with, 115-119, 173.
Mare and foal form boards, experiments with, 82, 83, 172.
Martin, L. J., and de Gruchy, C., book by, 272.
Mateer, F., book by, 272.
  experiments by, 13.
Measurements, 22, 26-234.
Memory, 12, 52, 106-115.
Mental development, 9, 12, 25, 50-234, 258-261.
Mental Development in the Child and the Race, 8.
Mental traits, 171-174, 177-179.
Mental traits, relation of, to physical traits, 177-179.
Merrill Palmer School, 16, 88, 103.
Methodenbuch für Väter und Mütter der Familien und Volker, publication of, 6.
Meumann, E., studies by, 11, 272.
Modeling clay, 199.
Montessori, M., book by, 272.
  work of, 14-16, 74, 100-102.
Montessori cylinders, experiments with, 83-86, 172.
Montessori dressing frames, use of, in tests, 100-103, 173.
Montessori tower, tests with, 86-88, 172.
Moore, K. C., book by, 272.
  records of, 10.
Motor activity, emphasis on, 6, 7.
Motor control, development of, 74*ff*.
Motor coördination, tests for, 89-105.
Motor development, 6, 7, 10, 13, 74-105.
Music, training in, 209-211, 226, 227.
Myers, C. E., tests by, 272, 273.
Myers, G. C., tests by, 12, 272, 273.

Nature training, 6, 14, 203-206, 224, 225.
Necker de Saussure, A., book by, 273.
  educational theory of, 7, 8.

Netschajeff, A., studies by, 10, 273.

New Lanark (England), school at, 15.

New York Bureau of Educational Experiments, 16.

Nice, M. M., study by, 11, 273.

Noon, G. P., studies by, 10, 273.

Norms, establishment of, 3, 11, 22, 33-35.

Norsworthy, N., and Whitley, M. T., book by, 8, 273.

Notes on Child Study, 8.

Number concepts, 10, 12, 51, 109, 155-164.

Nursery schools, 15, 16.

Oakden, E. C., and Sturt, M., studies by, 11, 164, 273.

Oberlin, school of, 15.

Observation, training in, 6, 7.

Occupational activities, list of references on, 289, 290.

Occupations for older child, 219-234.
  for younger child, 201-219.

Oltuszewski, W., studies by, 11, 273.

Oppenheim, N., book by, 8, 273.

Orbis Pictus, publication of, 5.

Originality, in designs, 146-148.
  in use of material, 189, 195, 198.

Otis, A. S., tests by, 12, 273.

Outlines of Child Study, 8.

Owen, G., book by, 15, 273.

Owen, Robert, school of, 15.

Paper weaving, 197, 198.

Paris, infant schools in, 16.

Parties, preparation for, 217, 218, 234.

Pavlov, experiments by, 13.

Pearson correlation, 60, 61, 67, 70.

Pearson, formula, 174.

Pencils, 199, 200.

Perception, tests in, 12, 75, 106-115, 123-128.

Percepts, 10, 24.

Perez, B., book by, 9, 273.

Perforation test, 95-98, 172.

Performance tests, 10, 11.

Perseveration, 63.

Personality, traits of, 235-240.

Pestalozzi, J. H., book by, 273.
  industrial training advocated by, 6, 7, 9.

Physical education, 206-219, 226.
  list of references on, 288.

Physical growth, 22, 26-50, 177-179, 256-258.

Physical Growth of Children from Birth to Maturity, 27.

Physical measurements, 22, 26-49.
  charts of, 28, 29.

Physical traits, relation of, to mental traits, 177-179.

Phonograph, use of, 192, 193.

Phonograph records, list of, 283-287.

Physiological changes, 2, 42-46.

Pictures, use of, in tests, 106, 113-115, 130-135, 173.

Pintner, R., and Anderson, M. M., tests by, 10, 119, 120, 122, 123, 273.

Pintner, R., and Cunningham, B. V., tests by, 12, 273.
Pintner, R., and Paterson, D. G., tests by, 10, 82, 106, 111, 115, 117, 274.
Play, training through, 7, 12, 253, 254.
Playmates, attitude toward, 244, 248.
Porteus, S. D., tests by, 10, 273.
Porteus maze, use of, in tests, 90-94, 103, 172.
Practice, effect of, in tests, 170, 171.
Preschool child, treatises on, 5-8.
Preschool laboratory, apparatus in, 186-200.
  description of, 18-22.
  program in, 180-186.
  research in, 22, 23.
  work of, 3.
Pressey, S. L., tests by, 12, 273.
Preyer, W., books by, 274.
  experiments by, 9, 10.
Program, daily, in preschool laboratories, 21-23, 180-186.
Proportion, tests in, 150, 151.
Prussia, infant schools in, 16.
Psychanalysis, 12, 13.
Psychologie des Kindes, 8.
Psychology, contribution to, 3, 4.
Psychological experiments, results of, 58, 59, 237.

Rasmussen, V., book by, 8, 274.
Reading, 219-222.
Recognition, 57, 63.
Rediscovery of child, 2-25.
References, 273-276.
Reymert, M. L., studies by, 12, 274.
Rhythm, tests in, 141-145.
Robinson, J. B., book by, 274.
Roentgenograms, 40-42, 44-46.
Rousseau, J. J., book by, 274.
  educational theory of, 5, 6.
Rugg, H. O., book by, 274.
  statistics of, 46.

Sand table, use of, 189-191.
Schäfer, P., studies by, 11, 274.
Schmidt, H., studies by, 10, 274.
School of Infancy, publication of, 5.
Scissors, use of, 194.
Scupin, E., and Scupin, G., diary of, 10, 274.
Seele des Kindes, 9.
Seguin, devices of, 14, 80.
Sense training, 14, 15.
Sewing cards, 196, 197.
Sex, influences of, in tests, 13, 45-49, 171-174, 177-179.
Sheppard-Towner Act, purpose of, 1.
Shinn, M. W., books by, 9, 10, 274, 275.
Ship, use of, in test, 122, 123, 173.
Sigismund, B., study by, 9, 275.
Sikorsky, I. A., book by, 8, 275.
Simon, T., book by, 275.
  outline of, 10.

Smith, Madorah, experiments by, 132.
Soap bubbles, 196.
Social attitudes, study of, 243-254.
Social development, 235-254, 263-265.
Social perception, growth of, 11, 12.
Socialization, 7, 12, 13.
Socialized education, 13, 14.
Song books, list of, 280-282.
Speech, tests in, 134-140.
Stanford-Binet tests, 52-58, 61, 62, 64, 130, 152, 172, 175-177, 258.
Stern, L. W., book by, 275.
Stern, L. W., and Stern, C., studies by, 10-12, 164, 275.
Sully, J., book by, 8, 275.
Supply houses, list of, 291, 292.
Sylvester, R. H., book by, 275.

Taine, H., book by, 11, 275.
Tanner, A. E., book by, 8, 275.
Teeth, development of, 44, 45.
Terman, L. M., tests by, 12, 133, 275.
Thom, D. A., book by, 275.
  clinics of, 13.
Thorndike, E. L., book by, 8, 11, 275, 276.
  tests by, 132.
Three-hole test, 94, 95, 172.
Tiedemann, D., books by, 276.
  educational theory of, 9.
Time, concepts of, 141-145, 164-169.
Town, C., study by, 12, 95, 113, 276.
Tracing path, use of, in tests, 103-105, 173.
Tracy, F., study by, 11, 276.
Training, results of, in preschool laboratories, 24, 25, 240-242.

University Observational School, training in, 21, 22.

Verry, Ethel, experiments by, 243.
Visual memory, tests in, 106-115.
Vocabulary, extension of, 25, 54, 55, 130-133.
Vowels, pronunciation of, 137.

Waddle, C. W., studies by, 11, 276.
Walbach (France), school at, 15.
Walking board, use of, 98-100, 172.
Wallin, J. E. W., tests by, 10, 74, 276.
Wallin pegs, experiments with, 74-80, 172.
Washburn, Ruth, tests by, 145, 150.
Watson, J. B., studies by, 13, 276.
Webber, J. J., tests by, 275.
Weight, concepts of, 152-154; effect of, 177, 178.
  norms for, 34-39.
Wellman, Beth, experiments by, 104.
Whipple, G. M., book by, 276.
White, W. A., book by, 12, 276.

Woodworth, R. S., and Wells, F. L., tests by, 88, 89, 133, 276.
Wooley, H. T., studies by, 12, 13, 16, 276.
Wooley, H. T., and Cleveland, E., tests by, 11, 84-87, 276.
Writing, training in, 222-224.
Wundt, experimntal psychology begun by, 2.

Zero order correlations, 174, 175.